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(Modified)

Building Energy Handbook

Volume 2
Forms for Energy Survey and Appraisal

December 1976

Prepared For:
Energy Research & Development Administration
Division of Building and Community Systems
Under Contract No. E(49-1)-3853

Project Managed By:
Division of Facilities and Construction Management

The BUILDING ENERGY HANDBOOK consists of two volumes:

Volume 1: Methodology for Energy Survey and Appraisal (ERDA 76/163/1)

Volume 2: Forms for Energy Survey and Appraisal (ERDA 76/163/2)

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BUILDING ENERGY HANDBOOK

VOLUME 2

FORMS FOR ENERGY SURVEY AND APPRAISAL

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CHAPTER 1

INTRODUCTION

CHAPTER 1

INTRODUCTION TO VOLUME 2

Volume 2 of the BUILDING ENERGY HANDBOOK contains the building energy survey and appraisal forms, within the following categories:

- Forms for Selection of Buildings for Detailed Energy Studies presented in Chapter 2.
- Forms for Building Energy Survey and Appraisal presented in Chapter 3.
- Forms for Building Energy Conservation Opportunity (ECO) Survey and Appraisal presented in Chapter 4.

The building selection forms reflect the methodology presented in Chapter 2, Volume 1 and provide the major characteristics of all buildings on a site, to be used as a basis for grouping buildings by size, type, function, energy consumption, energy systems and ECO potential. They assist in the selection of buildings with high energy conservation potential for detailed energy studies.

The forms for building energy appraisal reflect the methodology presented in Chapter 3, Volume 1, and help assess the actual energy consumption within various energy systems in a building, when system by system metering is not available. The forms also assist in highlighting those building energy systems which have consumptions higher than typically encountered for the respective systems.

The ECO survey and appraisal forms reflect the methodology presented in Chapter 4, Volume 1, and help collect and present in-depth data for the ECOs under consideration. The in-depth survey forms included in this volume are considered representative for energy systems in office-laboratory type buildings. These forms should be adapted and, for energy systems not covered herein, new ones should be developed to reflect detailed, actual local conditions. The economic appraisal forms assist in ranking the feasible ECOs based on savings/investment ratios and payback periods.

The specific purpose of each form as well as the section and page in Volume 1 where the form is referenced are presented on the page preceding each form.

CHAPTER 2

SELECTION OF BUILDINGS FOR DETAILED ENERGY STUDIES

FORM 2-1

BUILDING DATA SUMMARY SHEET

REF: SECTION 2B-1, Page 2-3, Vol. 1

PURPOSE: A synopsis of major available data for all buildings on the site. To be used as a basis for grouping of buildings by size, type, function, energy consumption and energy costs.

EY AND APPRAISAL

FORM 2-1
PAGE 1 OF 1
DATE:
BY:

BLDG. NO.	DESCRIPTION/ FUNCTION	GROSS FLOOR AREA SQ.FT.	EL	Y INDEX SQ.FT/YR	PEAK DEMAND		BILLED & ALLOCATED COSTS DOLLARS			
			10^3 KWH	SOURCE	ELECT. K.W.	STEAM LB/HR	ELECT. BILLED	FUEL BILLED	OTHER COSTS	TOTAL

FACILITY:

BUILDING ENERGY SURVEY AND APPRAISAL

BUILDING DATA SUMMARY SHEET

FORM 2-1
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DATE:
BY: ______

BLDG. NO	DESCRIPTION/ FUNCTION	GROSS FLOOR AREA SQ.FT.	ELECTRICITY			STEAM			FUEL OIL		NATURAL GAS		OTHER FUEL		TOTAL 10^6 BTU		WATER 10^6 GAL.				ENERGY INDEX 10^3 BTU/SQ.FT/YR		PEAK DEMAND		BILLED & ALLOCATED COSTS DOLLARS			
			10^3 KWH	10^6 BTU BLDG BDRY	10^6 BTU SOURCE	10^3 LBS	10^6 BTU BLDG BDRY	10^6 BTU SOURCE	10^3 GAL.	10^6 BTU	10^3 CF	10^6 BTU		10^6 BTU	BLDG. BDRY	SOURCE	DOM.	CANAL	LAB.	TOTAL	BLDG. BDRY	SOURCE	ELECT. KW.	STEAM LB/HR	ELECT. BILLED	FUEL BILLED	OTHER COSTS	TOTAL

FORM 2-2

BUILDING QUESTIONNAIRE

EF: SECTION 2B-4, Page 2-7, Vol. 1.

RPOSE: A questionnaire to collect information from ilding staff concerning building characteristics, erating conditions, energy consuming systems, and energy age within representative individual buildings. All ta available from Form 2-1 should be indicated on rm 2-2 by the energy study team, prior to distribution.

e Building Questionnaire is intended to provide additional ta for building selection and preparation of the walk rough survey.

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EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

BUILDING QUESTIONNAIRE

FORM 2-2
PAGE 1 OF 7
DATE:
BY:

A

1. INDICATE BY CHECK MARK.

B

FOR NO. OF OCCUPANTS INDICATE NO. DURING NORMAL WORKING HOURS, AND AVERAGE PERCENTAGES OF FULL OCCUPANCY AT OTHER TIMES.

A. PHYSICAL

1. BUILDING FUNCTIONS:. ...OFFICE ...LABORATORIES ...RESIDENTIAL
...OTHER (SPECIFY).....
2. LIST ANY SPECIAL PROCESSES.....
3. TOTAL FLOOR AREA.....SQ.FT.
% COOLED .....
% HEATED ONLY .....
% VENTILATED ONLY .....
% WITHOUT HVAC.....
4. TOTAL EXPOSED VERTICAL AREA.....SF
% NET WALL
% GLASS
5. ROOF AREA.....SF %SKYLIGHT.....
6. NO. OF FLOORS..... 7. AGE OF BLDG...YRS

B. OCCUPANCY

(1)	(2) OFFICE	(3) LABORATORY	(4) PROCESS	(5) RESIDENTIAL	(6)	(7)	(8)	(9) TOTAL
NO.OF OCCUPANTS								
NORMAL WORKING HRS.								
%OCCUPANTS EVENING								
%OCCUPANTS NIGHT								
%OCCUPANTS SATURDAY								
%OCCUPANTS SUNDAY								
%OCCUPANTS HOLIDAYS								

1. SPECIAL OCCUPANCY CONDITIONS (HIGH OCCUPANCY ZONES, PEAK OCCUPANCY HOURS, ROUND-THE-CLOCK OCCUPANCY, ETC.).....
.....
2. NATURE AND IMPORTANCE OF AFTER-HOUR USE.....
.....
3. SPECIFIC SERVICES REQUIRED AFTER HOURS AND INTENSITY LEVEL (HVAC, LIGHTING, PROCESS, STEAM, ETC.).....
.....

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

BUILDING QUESTIONNAIRE

FORM 2-2
PAGE 2 OF 7
DATE:
BY

C. ENERGY SYSTEMS SUMMARY

1. ENERGY ENTERING AND/OR GENERATED WITHIN BUILDING (INDICATE E OR G)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
	DESIGN CAPACITY		BUILDING DEMANDS			ANNUAL USAGE		METERING DATA			
TYPE	QUANTITY	PHYS. UNITS	ANNUAL PEAK	DATE	ANNUAL MIN.	QUANTITY	PHYS. UNITS	INDICATOR	RECORDER	TOTALLIZER	REMARKS

2. ENERGY DISTRIBUTION WITHIN BUILDING

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)				
	ELECTRICITY KW			ENERGY MEDIA 2				ENERGY MEDIA 3			
	CONNECTED	ANNUAL DEMAND NON-COINC	ANNUAL DEMAND COINC	PRESS OR TEMP. LEVEL	CAPACITY & PHYS. UNITS	COINCIDENT PEAK	ANNUAL USAGE				
POWER GEN.											
LTG. & RECEPTACLES											
COMFORT REFRIGERATION											
COMFORT HEATING											
DOMESTIC WATER HTG.											
COMFORT AUXILIARIES											
PROCESS											
GENERAL BLDG. SERVS.											
OTHER											
TOTALS											

3. MAJOR ENERGY CONVERSION EQUIPMENT

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
TYPE	UNIT NO.	FUNCTION	RATED CAPACITY	PEAK LOADING	HRS/YR OPERATION	ESTIMATED AVERAGE LOAD FACTOR	ANNUAL USAGE	REMARKS

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

BUILDING QUESTIONNARE

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D. WATER CONSUMPTION

(1)	(2)	(3)		(4)	(5)	(6)
	SOURCE	PRESSURE PSIG MAX.	PRESSURE PSIG MIN.	MAX DEMAND GPH	ANN. USAGE GAL.	METERED OR ESTIMATE
DOMESTIC						
LABORATORY						
PROCESS						
COOLING						

E

DESCRIBE SYSTEM, ENERGY DEMAND LEVEL AND USAGE

E. OTHER ENERGY SYSTEM (I.E. COMPRESSED AIR, VACUUM, ETC.).....
.....
.....

F

INDICATE ANY MAJOR HEATED EFFLUENTS (SUCH AS COOLING WATER), THEIR SOURCE, QUANTITY AND TEMPERATURE

F. EFFLUENTS
.....
.....
.....

G

THESE CLASSIFICATIONS REFER TO THE MEDIA WHICH TRANSPORT THE CENTRALLY PRODUCED COOLING (I.E. CENTRALIZED AIR, WATER, OR COMBINATION; OR SCATTERED, SELF-CONTAINED REFRIGERATION UNITS) INDICATE THE APPROXIMATE % OF TOTAL BLDG COOLING IN EACH CATEGORY, % NORMAL OUTSIDE AIR/SUPPLY AIR, AND CAPABILITY OF EMPLOYING OUTSIDE AIR FOR "FREE" COOLING.

G. HVAC SYSTEM SUMMARY:

1. ALL-AIR: SINGLE ZONE...., TERMINAL REHEAT...., VAR AIR VOL....., DUAL DUCT....., MULTIZONE...., CEILING INDUCTION...., HUMIDIFICATION ...., PERIMETER...., OR INTERIOR...., % OF TOTAL COOLING...., %NORMAL OA/SA...., OA COOLING CYCLE.....

2. AIR & WATER: TWO-PIPE...., THREE-PIPE...., (TERMINAL....OR RETURN.....MIX), FOUR PIPE...., INDUCTION...., LOW PRESSURE PRIMARY AIR...., OR FAN COIL....., DUAL-DUCT...., RADIANT PANEL....., HUMIDIFICATION....., PERIMETER...., OR INTERIOR....., % OF TOTAL COOLING ...., % NORMAL OA/SA....., OA COOLING CYCLE.....

3. ALL-WATER: TWO-PIPE...., THREE-PIPE...., (TERMINAL..... OR RETURN..... MIX), FOUR-PIPE ....., FAN COIL....., UNIT VENTILATOR...., VALANCE....., OUTDOOR AIR BY SEPARATE SYSTEM ....., WALL OPENINGS...., OR INFILTRATION....., PERIMETER....., INTERIOR....., % TOTAL COOLING.....

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

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4. MULTIPLE UNIT, UNITARY (SELF-CONTAINED): WINDOW..... OR THRU-THE-WALL ROOM UNITS, ROOF TOP.... OR INDOOR.... UNIT, SINGLE....., OR MULTIPLE....., PERIMETER..... OR INTERIOR....., COMPR..... OR ABS....., % TOTAL COOLING....., % NORMAL OA/SA....., OA COOLING CYCLE.....

5. PANEL HEATING AND COOLING: WATER.... IN FLOOR...., CEILING...., WALL...., LUMINAIRE....., OR LOUVERS....; AIR .....IN FLOOR....OR CEILING....; ELECTRIC CABLE.... IN FLOOR....., CEILING....., OR WALL.....; % OF TOTAL COOLING.....

6. ENERGY CONSERVATION: HEAT PUMP...., HEAT WHEEL....., RUN-AROUND....., HEAT PIPE....., HEAT REMOVAL BY NON-REFRIGERATED MEDIUM.....(I.E. EVAPORATIVE COOLING....., WATER COOLED LUMINAIRE.....), HOT WATER..... AND/OR CHILL WATER..... STORAGE TANK, OTHER.....
.....

7. COL.(2) UNDER TYPE INDICATE WHETHER PNEUMATIC, ELECTRONIC OR ELECTRIC.
COLS. (3) THROUGH (7) WHERE CONTROLS DO NOT APPLY TO WHOLE BUILDING INDICATE WINGS, ROOMS ETC. TO WHICH THEY DO APPLY.

7. CONTROLS

(1)	(2) TYPE	(3)	(4)	(5)	(6)	(7)	(8)	(9)
YEAR ROUND TEMP. CONTROL								
AUTOMATIC TEMP. SETBACK								
AUTOMATIC HUMIDITY CONT.								
AUTOMATIC PRESSURE CONT.								

2. IS THERE A CENTRALIZED AUTOMATIC HVAC CONTROL SYSTEM ..... IF SO DESCRIBE:
.....

H

1. COL. (2) INDICATE WHETHER INDOORS/OUTDOORS AND ROUGH LOCATION, E.G. "B WING", OR "N", "E", ETC.
COL. (8) INDICATE WHETHER DRY TYPE, SEALED OR LIQUID COOLED, FAN COOLED FOR ADDED CAPACITY.
COL(9) INDICATE IF TIED TO OTHER UNITS.

H. ELECTRICAL SYSTEM SUMMARY

1. TRANSFORMERS

(1) IDENTIFICATION	(2) LOCATION	(3) QUANTITY	(4) PHASE	(5) KVA	(6) PRIMARY V.	(7) SECONDARY V.	(8) TYPE	(9) REMARKS

EXPLANATORY NOTES	FACILITY: BUILDING: **BUILDING ENERGY SURVEY AND APPRAISAL**	
	BUILDING QUESTIONNAIRE	FORM: 2-2 PAGE 5 OF 7 DATE: BY: _____

2. INDICATE TYPE OF METERING BY CHECK MARK.

2. METERING EQUIPMENT: TOTAL BUILDING METERING..... INDIVIDUAL BUILDING METERING.....
KWH..... KW DEMAND..... KVAR..... VOLTMETER..... AMMETER.....

3. INDICATE TYPE OF LOADS SERVED UNDER EACH VOLTAGE, E.G. ALL, LIGHTING, MOTORS, ETC. IF COLUMN (3) IS USED INDICATE VOLTAGE ETC.

3. SECONDARY DISTRIBUTION VOLTAGE

120/208 V 3Ø 4 WIRE	277/480 V 3Ø 4 WIRE	OTHER

4 AND 5. INDICATE BY CHECK MARK SYSTEMS USED, AND EXTENT OF USAGE.

4. BRANCH CIRCUITS:

	ALL	MOST	SOME
. CABLE & CONDUIT			
. UNDER FLOOR DUCT			
. IN RAISED FLOOR			
. IN HUNG CEILING			
. EXPOSED			
. BUS DUCT			

5. LIGHTING CONTROL:

	ALL	MOST	SOME
. LOCAL WALL SWITCHES			
. PANEL SWITCHES			
. REMOTE CONTACTOR			
. LOW VOLTAGE RELAY			
. MANUAL TIME SWITCH			
. AUTO TIME SWITCH			
. PHOTOELECTRIC			
. BUILDING AUTOMATION SYSTEMS CONTROL			
. OTHER (LIST)			

EXPLANATORY NOTES

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(1) ENTER OFFICE, LAB, CORRIDOR, ETC.
(3) ENTER INCANDESCENT, FLUORESCENT, ETC.
(4) USE ONLY IF KNOWN
(6) INDICATE WEEK-END AND HOLIDAY USE AS A PERCENT OF DAILY USE.

6. LIGHTING

(1) TYPE OF SPACE	(2) APPROXIMATE % TOTAL FLOOR AREA	(3) FIXTURE TYPE	(4) DESIGN FOOT-CANDLES	(5) DAILY HOURS OF USE WORK DAYS	(6) DAILY HOURS OF USE NON-WORK DAYS

I. BUILDING EQUIPMENT: (MAJOR ITEMS SUCH AS ELEVATORS, ESCALATORS, DATA PROCESSING, FOOD PREPARATION). WHERE POSSIBLE INDICATE MAXIMUM ENERGY CONSUMPTION, FUNCTION, OPERATING PROFILE (I.E. HRS/YR OPERATION AND AVERAGE LOAD FACTOR).....

.....

.....

.....

J. INDUSTRIAL EQUIPMENT (MAJOR ITEMS NOT FULLY IDENTIFIED ABOVE): INDICATE MAXIMUM ENERGY CONSUMPTION, FUNCTION, OPERATING PROFILE (I.E. HRS/YR OPERATION AND AVERAGE LOAD FACTOR).....

.....

.....

.....

.....

EXPLANATORY NOTES	FACILITY: BUILDING: **BUILDING ENERGY SURVEY AND APPRAISAL**	
	BUILDING QUESTIONNAIRE	FORM: 2-2 PAGE 7 OF 7 DATE: BY:

K

INDICATE ENERGY CONSERVATION MEASURES WHICH HAVE ALREADY BEEN TAKEN.

K. ENERGY CONSERVATION MEASURES INSTITUTED

1. HVAC CONSERVATION MEASURES

	SHUTDOWN	SETBACK	OTHER (DESCRIBE)
HEATING			
COOLING			
VENTILATION			

2. LOAD MANAGEMENT.....
3. SURPLUS TRANSFORMER SHUTDOWN.....
4. POWER FACTOR CORRECTION.....
5. ON PREMISES GENERATOR TO MEET PEAK DEMAND.....
6. LAMP & BALLAST REMOVAL.....
7. EXCESS LIGHTS TURNED OFF AT PANEL.....
8. SPECIAL LIGHTING CONTROLS ADDED (INDICATE TYPE).....
.....
9. REPLACEMENT OF LAMPS WITH HIGH EFFICIENCY LAMPS (DESCRIBE).....
.....
.....
10. REPLACEMENT OF LAMPS WITH LOWER WATTAGE LAMPS (DESCRIBE).....
.....
.....
.....
11. HOT WATER PRESSSURE/TEMPERATURE REDUCTION .....
.....
12. IMPROVED MAINTENANCE OF EQUIPMENT AND CONTROLS.....
.....
13. BUILDING STRUCTURE HEAT GAIN/LOSS CONTROL.....
.....

FORM 2-3

ECO CHECKLIST

REF: SECTION 2B.5.1, Page 2-9, Vol. 1

PURPOSE: The list of building ECOs included in this Handbook will assist the energy study team to identify possible applicable ECOs during the review of the Building Questionnaire and during the Walk-Through Survey.

Space to enter additional ECOs has been provided.

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	BUILDING ENERGY SURVEY AND APPRAISAL
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INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
A. GENERAL				
A-1 ECO ORIENTED BACKGROUND DATA	( )	( )	( )	INDICATE
A-1.1 ENERGY RELATED RECORD KEEPING	( )	( )	( )	AVAILABILITY
A-1.2 HISTORY OF FACILITY'S ENERGY CONSERVATION ACTIVITY	( )	( )	( )	OF INFORMATION
B. BUILDING SKIN				
SK-1 CONSTRUCTION	( )	( )	( )	
SK-1.1 SEALING OF EXPOSED SURFACES	( )	( )	( )	
SK-1.2 BUILDING INSULATION	( )	( )	( )	
SK-2 ENTRANCE PROTECTION	( )	( )	( )	
SK-3 HIGH BAY AREAS	( )	( )	( )	
SK-4 ROOF COOLING	( )	( )	( )	
C. BUILDING COMFORT, USE & OCCUPANCY				
COM-1 REVISED ROOM TEMPERATURES	( )	( )	( )	
COM-2 REVISED ROOM HUMIDITY	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 2 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
COM-3	REVISED VENTILATION CRITERIA	( )	( )	( )	
COM-4	CONSOLIDATE FUNCTIONS	( )	( )	( )	
COM-5	LET THE OUTPUT TRACK THE USAGE PROFILES	( )	( )	( )	
D.	ELECTRICAL SYSTEMS				
D.1	SERVICE AND DISTRIBUTION				
ES-1	TRANSFORMERS	( )	( )	( )	
ES-1.1	UTILIZATION OF EFFICIENT TRANSFORMERS	( )	( )	( )	
ES-1.2	REDUCTION OF TRANSFORMER LOSSES	( )	( )	( )	
ES-2	VOLTAGE REGULATION IMPROVEMENT	( )	( )	( )	
ES-3	REDUCTION OF DISTRIBUTION FEEDER LOSSES	( )	( )	( )	

EXPLANATORY NOTES	FACILITY:	BUILDING:
	BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 3 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
D.2	POWER GENERATION	( )	( )	( )	
EG-1	TOTAL ENERGY (T/E)	( )	( )	( )	
EG-2	SELECTIVE ENERGY (S/E)	( )	( )	( )	
EG-2.1	S/E WITH FIXED SEGREGATED LOAD-NO UTILITY STANDBY	( )	( )	( )	
EG-2.2	S/E WITH SEGREGATED LOAD AND UTILITY STANDBY	( )	( )	( )	
EG-2.3	S/E WITH VARIABLE ON-PREMISES POR-TION PARALLELED WITH UTILITY	( )	( )	( )	
EG-2.4	S/E WITH VARIABLE ON-PREMISES POR-TION WITHOUT PARALLELING	( )	( )	( )	
EG-2.5	S/E FOR VARIABLE ON-PREMISES SHAFT POWER-UTILITY ALTERNATE	( )	( )	( )	
D.3	LOAD MANAGEMENT				
ELM-1	REDUCTION OF ENERGY CONSUMPTION	( )	( )	( )	
ELM-2	POWER FACTOR IMPROVEMENT	( )	( )	( )	
ELM-3	DEMAND LIMITING	( )	( )	( )	
ELM-3.1	LOAD SHEDDING	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 4 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
FLM-3 2	SCHEDULING	( )	( )	( )	
D.4	LIGHTING				
EL-1	LIGHTING INTENSITY REDUCTION AND OPTIMIZATION	( )	( )	( )	
EL-2	TASK/AMBIENT LIGHTING DESIGN	( )	( )	( )	
EL-3	SELECTIVE LIGHTING CONTROL	( )	( )	( )	
EL-4	REPLACEMENT OF LAMPS	( )	( )	( )	
D.5	MAINTENANCE				
EM-1	VOLTAGE LEVELS	( )	( )	( )	
EM-1.1	TRANSFORMER TAP SETTINGS	( )	( )	( )	
EM-1.2	MOTORS	( )	( )	( )	
EM-2	LIGHTING	( )	( )	( )	
EM-2.1	LAMPS	( )	( )	( )	
EM-2.2	LUMINAIRES	( )	( )	( )	
EM-2.3	BALLASTS	( )	( )	( )	

EXPLANATORY NOTES	FACILITY:	BUILDING:
	BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 5 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
E HEATING AND COOLING SYSTEMS				
E.1 FUEL HANDLING & COMBUSTION SYSTEMS				
HF-1 COMBUSTION CONTROL SYSTEMS	( )	( )	( )	
HF-2 REPLACE OR MODIFY STEAM BURNERS WITH AIR ATOMIZATION	( )	( )	( )	
HF-3 FUEL OIL PREPARATION & HANDLING	( )	( )	( )	
HF-3.1 AVOID CONTINUOUS PUMPING OF FUEL OIL	( )	( )	( )	
HF-3.2 MONITOR & CONTROL FUEL OIL VISCOSITY	( )	( )	( )	
E.2 HEAT GENERATING PLANTS	( )	( )	( )	
HH-1 DEVELOP LOGS FOR PERFORMANCE MONITORING	( )	( )	( )	
HH-2 IMPROVE HEAT BALANCE	( )	( )	( )	
HH-3 AVOID STAND-BY FIRING OF RESERVE HEAT GENERATOR	( )	( )	( )	
HH-4 REDUCE BLOW-DOWN LOSSES	( )	( )	( )	
HH-5 REDUCE STACK LOSSES	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
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INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
E.3	REFRIGERATION PLANTS				
HR-1	ALLOW HEAD PRESSURE AND/OR COOLANT TEMPERATURE TO REDUCE	( )	( )	( )	
HR-1.1	MAINTAIN MINIMUM CT BY CLEANING AND PURGING	( )	( )	( )	
HR-2	KEEP CHILLER LEAVING WATER TEMPERATURE (LWT) HIGH	( )	( )	( )	
HR-2.1	SCHEDULED CHILLER LWT CONTROL	( )	( )	( )	
HR-3	OBTAIN REFRIGERATION AT A FRACTION OF NORMAL ENERGY INPUT	( )	( )	( )	
HR-4	EFFECT OF VARIABLE SPEED PUMPING ON CHILLER PERFORMANCE	( )	( )	( )	
HR-5	HEAT PUMP SYSTEMS	( )	( )	( )	

EXPLANATORY NOTES	FACILITY:	BUILDING:
	BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 7 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
E.4 STEAM DISTRIBUTION SYSTEMS	( )	( )	( )	
HS-1 SYSTEM PRESSURE REDUCTION	( )	( )	( )	
HS-2 CONTROL OF STEAM SHUT-OFF TO SELECTED BRANCH MAINS	( )	( )	( )	
HS-3 ELIMINATE OR FIND ALTERNATE HEAT SOURCE FOR RESIDUAL LOADS	( )	( )	( )	
E.5 CONDENSATE RETURN & FEEDWATER SYSTEMS				
HCR-1 CONDENSATE LEAKAGE	( )	( )	( )	
HCR-2 INSULATION	( )	( )	( )	
HCR-3 PUMPING STATIONS	( )	( )	( )	
HCR-4 AVOID FLASH LOSSES	( )	( )	( )	
HCR-4.1 INJECT COLD MAKE-UP WATER INTO CONDENSATE RETURN TANK	( )	( )	( )	
HCR-4.2 CONNECT HPS & LPS FLASH VESSEL VENTS TO LPS LOADS	( )	( )	( )	
HCR-4.3 INSTALL VENT CONDENSER ON FLASH VESSELS	( )	( )	( )	

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

ECO CHECKLIST

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INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
HCR-4.3	INSTALL PUMPING EQUIPMENT TO HANDLE HOT CONDENSATE	( )	( )	( )	
HCR-5	REDUCE FEEDWATER (FW) PUMPING POWER REQUIREMENTS	( )	( )	( )	
HCR-5.1	REDUCE DISCHARGE PRESSURE OF FEED WATER (FW) PUMPS	( )	( )	( )	
HCR-5.2	LET PUMP ENERGY FOLLOW THE PLANT LOAD	( )	( )	( )	
E.6	HOT WATER DISTRIBUTION SYSTEMS				
HHW-1	BY-PRODUCT HOT WATER	( )	( )	( )	
HHW-2	CONVERSION OF STEAM TO HW	( )	( )	( )	
HHW-3	INSULATION MANAGEMENT	( )	( )	( )	
HHW-4	LOWER TEMPERATURE & RAISE DIFFERENTIAL	( )	( )	( )	
HHW-5	VARIABLE VOLUME PUMPING	( )	( )	( )	
HHW-6	SCHEDULE HOT WATER SUPPLY TEMPERATURE	( )	( )	( )	
HHW-7	CYCLE HOT WATER PUMPS	( )	( )	( )	
HHW-8	CHANGE SECONDARY PUMPING TO TERMINAL BOOSTING	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 9 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN, WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
E.7 CHILLED WATER DISTRIBUTION SYSTEMS				
HCH-1 PUMPING SYSTEMS	( )	( )	( )	
HCH-1.1 VARIABLE VOLUME PUMPING	( )	( )	( )	
HCH-1.2 PUMP CYCLING & SHUT-OFF	( )	( )	( )	
HCH-1.3 CHANGE SECONDARY TO TERMINAL BOOSTER PUMPING	( )	( )	( )	
HCH-2 INCREASE TEMPERATURE DIFFERENTIALS	( )	( )	( )	
HCH-3 RAISE CHILLED WATER SYSTEM TEMPERATURES	( )	( )	( )	
HCH-4 DECENTRALIZED LOOP	( )	( )	( )	
E.8 AIR HANDLING HVAC SYSTEMS				
HA-1 CONVERT CONSTANT VOLUME (CAV) SYSTEMS TO MODIFIED VARIABLE AIR VOLUME (VAV)	( )	( )	( )	
HA-1.1 CONVERSION OF DUAL DUCT TO VAV	( )	( )	( )	
HA-1.2 CONVERSION OF REHEAT TO VAV	( )	( )	( )	
HA-1.3 CONVERSION OF INDUCTION TO VAV-INDUCTION	( )	( )	( )	
HA-2 REDUCE OUTSIDE AIR (OA) LOAD	( )	( )	( )	
HA-3 CONTROL DISCHARGE AIR TEMPERATURES	( )	( )	( )	
HA-3.1 TERMINAL REHEAT COMPUTERIZED RESET	( )	( )	( )	
HA-3.2 DOUBLE DUCT SYSTEM COMPUTERIZED RESET	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 10 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN, WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
E.9 AIR-WATER HVAC SYSTEMS	( )	( )	( )	
E.10 ALL-WATER HVAC SYSTEMS	( )	( )	( )	
E.11 MULTIPLE UNIT AND UNITARY HVAC SYSTEMS	( )	( )	( )	
E.12 [illegible]VATION & EXHAUST SYSTEMS				
HVE-1 CONVERT CONSTANT VOLUME EXHAUST (CVE) TO VARIABLE VOLUME EXHAUST (VVE)	( )	( )	( )	
F PLUMBING SYSTEMS				
F.1 SERVICE HOT AND COLD WATER SYSTEMS	( )	( )	( )	
W-1 REDUCE PRESSURE	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 11 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS CLLUMN, WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
W-2	CONTROL FLOW	( )	( )	( )	
W-3	REDUCE SUPPLY TEMPERATURES	( )	( )	( )	
W-4	INSULATION	( )	( )	( )	
W-5	RECIRCULATE HOT WATER	( )	( )	( )	
F.2	COMPRESSED AIR SYSTEMS				
CA-1	REDUCE LEAKAGE LOSS	( )	( )	( )	
CA-2	REDUCE PRESSURES TO MINIMUM NECESSARY LEVEL	( )	( )	( )	
CA-3	DISTRIBUTE CLEAN, DRY AIR	( )	( )	( )	
F.3	WASTEWATER SYSTEMS				
WW-1	REDUCE WATER CONSUMPTION	( )	( )	( )	
WW-2, WW-3	SEGREGATE VARIOUS WASTEWATERS AND STORM-WATERS	( )	( )	( )	
WW-6	MISCELLANEOUS OPPORTUNITIES	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 12 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE INDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

		YES	NO	INVESTIGATE	REMARKS
G.	PUMPING SYSTEMS				
P-1	PUMPING AND STORAGE	( )	( )	( )	
P-2	SEQUENCED PARALLEL OR SERIES PUMPING	( )	( )	( )	
P-3	IMPELLER SHAVING OR DRIVE SPEED CHANGE	( )	( )	( )	
P-4	VARIABLE SPEED WITH EXISTING MOTORS	( )	( )	( )	
P-5	FREE COOLING WITH GROUND WATER	( )	( )	( )	
H.	COOLANT SYSTEMS				
C-1	ELIMINATE OR REDUCE REFRIGERATED COOLING	( )	( )	( )	
C-1.1	OBTAIN REFRIGERATION WITH LOW ENERGY INPUT	( )	( )	( )	
C-1.2	USE INDIRECT ATMOSTPHERIC COOLING FOR HEAT REJECTION FROM REFRIGERATED COOLANT SYSTEMS	( )	( )	( )	
C-1.3	SURFACE OR GROUNDWATER COOLANT SYSTEMS	( )	( )	( )	
C-2	PUMPING ENERGY REDUCTION IN COOLANT SYSTEMS	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 13 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE BOX INVESTIGATE. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
I. INDUSTRIAL PROCESS SYSTEMS				
IG-1 GENERAL	( )	( )	( )	
IF-1 HIGH FUEL CONSUMERS	( )	( )	( )	
IS-1 HIGH STEAM OR HOT WATER CONSUMERS	( )	( )	( )	
IE-1 HIGH ELECTRICAL CONSUMERS	( )	( )	( )	
J. MONITORING, CONTROL AND SURVEILLANCE SYSTEMS				
M-1 NO LOAD, PART LOAD & UNOCCUPIED PERIOD CONTROLS	( )	( )	( )	
M-1.1 AUTOMATE BY TIME CONTROL	( )	( )	( )	
M-1.2 AUTOMATE BY REMOTE SENSING SIGNAL	( )	( )	( )	
M-1.3 TRACK LOAD WITH AUTOMATIC EQUIPMENT CAPACITY CONTROL	( )	( )	( )	
M-1.4 MANUAL CONTROL	( )	( )	( )	
M-2 OUTSIDE AIR (OA) REDUCTION	( )	( )	( )	
M-3 INDIVIDUALIZE CONTROLS FOR OPTIMUM ENERGY USE	( )	( )	( )	
M-4 COMPUTERIZED ANALYSIS & CONTROL	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 14 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
K. WASTE ENERGY RECOVERY AND REDUCTION				
K.1 HVAC RECOVERY SYSTEMS				
WH-1 DIRECT RECYCLING OF SPENT AIR	( )	( )	( )	
WH-2 PURIFY EXHAUST AIR FOR RECYCLING	( )	( )	( )	
WH-3 RECOVER HEAT FROM BUILDING EXHAUST AIR SYSTEMS	( )	( )	( )	
WH-3.1 ROTARY AIR WHEELS & PLATE HEAT EXCHANGERS	( )	( )	( )	
WH-3.2 HEAT PIPE	( )	( )	( )	
WH-3.3 RUN-AROUND SYSTEM--CLOSED TYPE	( )	( )	( )	
WH-3.4 RUN-AROUND SYSTEM--OPEN TYPE	( )	( )	( )	
WH-4 RECOVER INTERNAL HEAT WITH HEAT PUMP	( )	( )	( )	
K.2 COMBUSTION AIR & FLUE GAS SYSTEMS				
WCF-1 PREHEAT COMBUSTION AIR AND/OR FW WITH FLUE GAS	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 15 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURBEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
K.3 HOT LIQUID EFFLUENT OR RECIRCULATING SYSTEMS				
WL-1 RECOVER HEAT FROM PROCESS COOLANT SYSTEMS	( )	( )	( )	
WL-2 RECOVER HEAT FROM WASTEWATER	( )	( )	( )	
K.4 HOT AIR, VAPOR OR GAS EXHAUST				
WHG-1 USE HOT AIR EXHAUST AS PREHEATED COMBUSTION AIR	( )	( )	( )	
WHG-2 RECOVER ENERGY FROM PROCESS GASES AND VAPORS	( )	( )	( )	
K.5 ENERGY LEAKAGE				
WLK-1 LEAKAGE & ENERGY LOSS MANAGEMENT FROM SITE ENERGY HANDBOOK	( )	( )	( )	
K.6 SOLID WASTE RECOVERY				
WSW-1 RECOVER HEAT FROM PYROLYSIS OF SOLID WASTE	( )	( )	( )	

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ECO CHECKLIST	FORM 2-3 PAGE 16 OF 16 DATE: BY:

INDICATE WHETHER THERE IS ANY POTENTIAL FOR THE ECO IN THE BUILDING BY CHECKING IN YES OR NO BOX AND INDICATE REASON IN THE REMARKS COLUMN. WHERE ECO IS TO BE INVESTIGATED DURING THE WALK-THROUGH SURVEY CHECK IN THE INVESTIGATE BOX. SPARE SPACE UNDER EACH MAJOR HEADING IS TO ALLOW ANALYST TO ENTER ADDITIONAL ECOs.

	YES	NO	INVESTIGATE	REMARKS
L. OPERATION AND MAINTENANCE				
O-1 OPTIMIZE O&M RECORDS AND ANALYSIS	( )	( )	( )	
O-2 PROGRAM CUSTODIAL OPERATIONS FOR ENERGY CONSERVATION	( )	( )	( )	
O-3 KEEP HEAT EXCHANGERS CLEAN	( )	( )	( )	
O-4 KEEP AIR & LIQUID CIRCULATING SYSTEMS IN OPTIMUM BALANCE	( )	( )	( )	

CHAPTER 3

ENERGY SURVEY AND APPRAISAL OF SELECTED BUILDINGS

APPRAISAL FORMS
ABBREVIATIONS

Btuh	=	Btu per hour
EFL Hrs	=	Equivalent Full Load Hours = Annual Energy/Peak Demand (i.e. Ann Kwh/Peak Dem kw; Ann Ton Hrs/ Peak Tons; etc.)
EI	=	Energy Index, Btu/SF floor area/yr (with some subscript options as for SF)
EI_b	=	Overall building EI
EI_c	=	EI for space cooling
EI_e	=	EI for electrical energy
EI_h	=	EI for space heating
EI_{hvac}	=	EI for space HVAC
EI_i	=	EI for interior partitions
EI_{lr}	=	EI for lighting and receptacle cooling load
EI_n	=	Nodal (or System) EI
EI_o (EI_{os} (EI_{ol}	=	EI for occupancy load; sensible or latent heat for SH) for LH)
EI_p (EI_{ps} (EI_{pl}	=	EI for process for SH) for LH)
EI_{hw}	=	EI for service hot water
EI_s	=	EI for solar load
EI_t	=	EI for total skin transmission (w/o solar)
EI_v (EI_{vs} (EI_{vl}	=	EI for Ventilation and/or infiltration load for SH) for LH)
LH	=	Latent Heat Btu or Btuh
SF_b	=	Building gross area heated, cooled or wiped with return air
SF_c	=	Floor area cooled, sq.ft
SF_g	=	Glass Area, sq.ft; heating, cooling, in wall or roof
SF_h	=	Floor area heated, sq. ft

SF_i = Interior partitions, sq.ft
SF_r = Roof area, sq.ft
SF_w = Net wall area, sq.ft; heating or cooling
SH = Sensible Heat Btu or Btuh
TH = Total Heat Btu or Btuh = SH + LH

FORM 3-1

PRELIMINARY ENERGY APPRAISAL FORMS

REF: SECTION 3B.2, Page 3-2, Vol. 1

PURPOSE: To organize raw information concerning prime energy flows into the building in a uniform fashion for use in the preliminary energy flow and balance diagram and in the building energy appraisal. See Forms 3-2, 3-3 and 3-4 for detailed energy appraisal.

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FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

NATURAL GAS

PRELIMINARY ENERGY APPRAISAL

FORM 3-1
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DATE:
BY: _____

ADJUST METER READINGS TO GIVE MONTHLY TOTALS.

ANY CONDITIONS SUCH AS LIMITATIONS ON GAS USAGE, SUPPLY CUT-OFF DURING PEAK DEMAND PERIODS SHOULD BE NOTED UNDER SPECIAL CONDITIONS.

1. NATURAL GAS USED

(1) MONTH	(2) MCF	(3) BTU X 10^6
JANUARY		
FEBRUARY		
MARCH		
APRIL		
MAY		
JUNE		
JULY		
AUGUST		
SEPTEMBER		
OCTOBER		
NOVEMBER		
DECEMBER		
TOTAL		

2. APPLICABLE RATE:

3. SPECIAL CONDITIONS:

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

FUEL OIL

PRELIMINARY ENERGY APPRAISAL

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DATE:
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ADJUST DELIVERY RECEIPTS TO GIVE MONTHLY TOTALS OF ACTUAL CONSUMPTION, OR USE METERED QUANTITIES WHEN AVAILABLE

1. FUEL OIL USED

(1) MONTH	(2) GALLONS	(3) GRADE	(4) HHV	(5) BTU X 10^6
JANUARY				
FEBRUARY				
MARCH				
APRIL				
MAY				
JUNE				
JULY				
AUGUST				
SEPTEMBER				
OCTOBER				
NOVEMBER				
DECEMBER				
TOTAL				

2. COST PER GALLON_____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

LPG-BUTANE AND PROPANE

PRELIMINARY ENERGY APPRAISAL

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3. COST- WHERE GAS IS PREMIXED WITH AIR, COST, HEATING VALUE AND QUANTITIES SHOULD BE INDICATED FOR GAS AS METERED.

1. DISTRIBUTION TO BUILDING
   FROM CENTRAL LPG TANKS____ FROM BUILDING LPG TANKS____

2. METERING
   ON RECEIPT, LPG_____ OR ENTERING BUILDING GAS_____

3. COST
   LIQUID_____ $/GAL GAS_____ $/MCF

4. HEATING VALUE
   LIQUID_____BTU/GAL GAS_____ BTU/MCF

5. QUANTITIES OF LPG USED

MONTH	AS METERED UNIT_____	BTU X 10^6	MONTH	AS METERED UNIT_____	BTU X 10^6
JANUARY			JULY		
FEBRUARY			AUGUST		
MARCH			SEPTEMBER		
APRIL			OCTOBER		
MAY			NOVEMBER		
JUNE			DECEMBER		
			TOTAL		

EXPLANATORY NOTES

FACILITY: BUILDING.

BUILDING ENERGY SURVEY AND APPRAISAL

ELECTRICITY

PRELIMINARY ENERGY APPRAISAL

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COLUMN (2): ENTER DAYS BETWEEN CONSECUTIVE METER READINGS

1. METERED DATA (KWH)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MONTH	DAYS IN PERIOD	POWER CENTER DESIGNATION						TOTAL
JANUARY								
FEBRUARY								
MARCH								
APRIL								
MAY								
JUNE								
JULY								
AUGUST								
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

2. TYPE OF METERS: KW..... KVAR.....
KWH..... OTHER.. .....

3. DEMAND PERIOD: 15 MIN..... 30 MIN.....

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

ELECTRICITY

PRELIMINARY ENERGY APPRAISAL

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CHECK WHETHER PEAK LOADS RECORDED ON DIFFERENT CENTERS ARE COINCIDENT OR NOT

USE APPROPRIATE LINE FOR KW OR KVAR

SHOW MAXIMUM AND MINIMUM PEAK DEMAND AT EACH CENTER WITH APPROPRIATE KW OR KVAR UNITS

4. PEAK KW AND KVAR: COINCIDENT____: NON-COINCIDENT____

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
MONTH		POWER CENTER DESIGNATION							NON COIN. PEAK
JANUARY	KW								
	KVAR								
FEBRUARY	KW								
	KVAR								
MARCH	KW								
	KVAR								
APRIL	KW								
	KVAR								
MAY	KW								
	KVAR								
JUNE	KW								
	KVAR								
JULY	KW								
	KVAR								
AUGUST	KW								
	KVAR								
SEPTEMBER	KW								
	KVAR								
OCTOBER	KW								
	KVAR								
NOVEMBER	KW								
	KVAR								
DECEMBER	KW								
	KVAR								
MAX.PEAK									
MIN.PEAK									

EXPLANATORY NOTES

FACILITY: BUILDING.

BUILDING ENERGY SURVEY AND APPRAISAL

ELECTRICITY

PRELIMINARY ENERGY APPRAISAL

FORM 3-1
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- COLUMN (5) = $\frac{(4)}{(3) \times (2) \times 24 \text{ HRS}}$
- COLUMN (6) : SEE APPENDIX 2 VOLUME 1
- COLUMN (7) = (6) x (3)

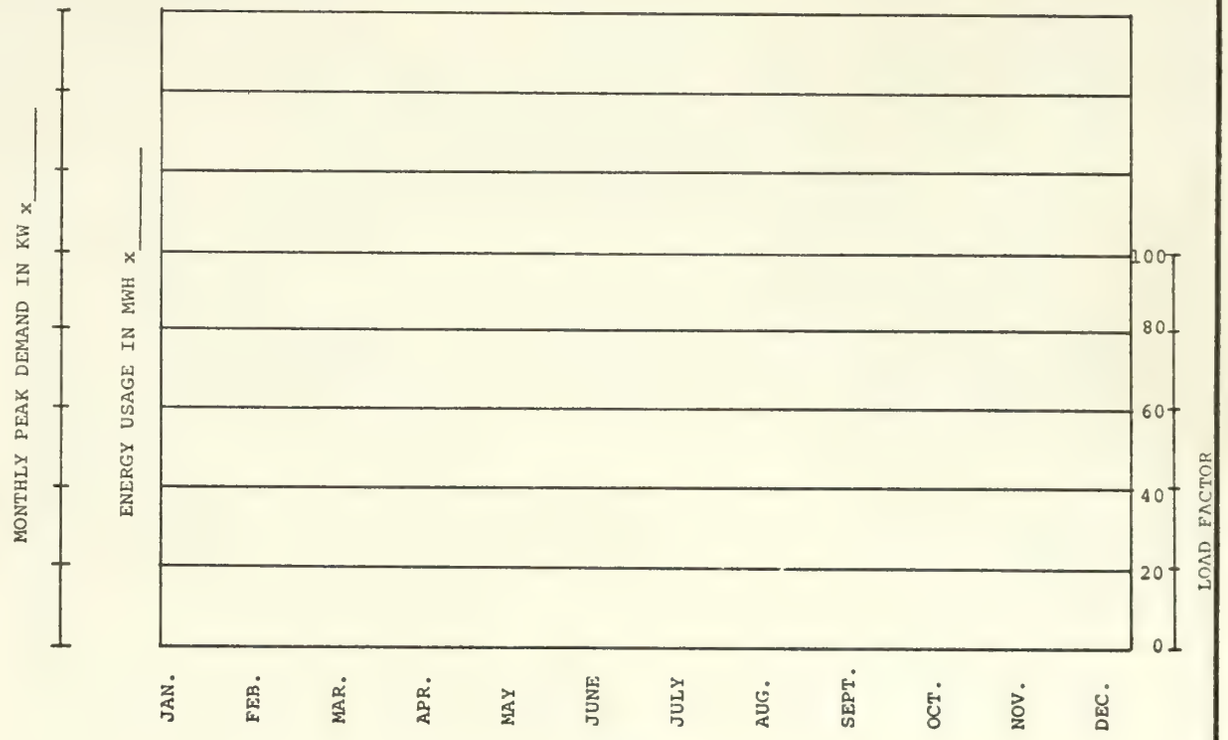
5. CALCULATION OF COINCIDENT DEMAND

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
MONTH	DAYS IN PERIOD	NON COINCIDENT DEMAND KW	USE KWH	LOAD FACTOR	COINCIDENCE FACTOR FROM TABLE APP2-6	COINCIDENT DEMAND KW	REMARKS
JANUARY							
FEBRUARY							
MARCH							
APRIL							
MAY							
JUNE							
JULY							
AUGUST							
SEPTEMBER							
OCTOBER							
NOVEMBER							
DECEMBER							
TOTAL							

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	ELECTRICITY PRELIMINARY ENERGY APPRAISAL	FORM 3-1 PAGE 7 OF 12 DATE: BY:

- FROM METER DATA PLOT EACH MONTH'S DEMAND (KW) AND USAGE (KWH)
- PREPARE SEPARATE SHEET FOR EACH POWER CENTER

6. ANNUAL PROFILE OF MONTHLY DEMAND AND USAGE



SERVICE NO. _____

USE ADDITIONAL SHEETS AS REQUIRED

EXPLANATORY NOTES

FACILITY: BUILDING.

BUILDING ENERGY SURVEY AND APPRAISAL

STEAM

PRELIMINARY ENERGY APPRAISAL

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1. (8) UNDER "SERVICE FLUCTUATION" INDICATE MINIMUM PRESSURE IN P.S.I.G.

2. (3)(5)(7)(9) ENTER SOURCE BTU

1. SOURCE INFORMATION

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
SOURCE	METER NO.	TYPE OF METER	SERVICE	STEAM CONDITION			SERVICE FLUCTUATION (P.S.I.G.)	MAX. CAPACITY (LB/HR)	REMARKS
				PRESS. (P.S.I.G.)	TEMP. (°F)	QUALITY (%)			

2. STEAM RECEIVED

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
MONTH	METER NO.		METER NO.		METER NO.		TOTAL	
	LBS	BTUx10^6	LBS	BTUx10^6	LBS	BTUx10^6	LBS	BTUx10^6
JANUARY								
FEBRUARY								
MARCH								
APRIL								
MAY								
JUNE								
JULY								
AUGUST								
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

3. CHARGEABLE COST PER LBS x 10^3

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

HOT WATER

PRELIMINARY ENERGY APPRAISAL

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EXPLANATORY NOTES

1.
(2) UNDER "TYPE" INDICATE WHETHER ORIFICE, POSITIVE DISPLACEMENT, TURBINE OR OTHER

(3) UNDER "UNITS" INDICATE UNITS MEASURED BY METER

·ADJUST METER READINGS TO GIVE MONTHLY TOTALS

2.
(2) (4) (6) (8)
·IF METER MEASURES UNITS OTHER THAN BTUS ENTER IN BLANK COLUMNS.

(3) (5) (7) (9)
ENTER SOURCE BTU.

1. METERING: COST PER LBS x 10^3 _____ PER BTU x 10^6 _____

(1) METER NO.	(2) TYPE	(3) UNITS	(4) AREAS SERVED	(5) TEMPERATURE (°F) NORMAL	(6) MAX.	(7) MIN.	(8) PRESS (PSIG.)	(9) REMARKS

2. HOT WATER RECEIVED

(1) MONTH	(2) METER NO.	(3) BTU x 10^6	(4) METER NO.	(5) BTU x 10^6	(6) METER NO.	(7) BTU x 10^6	(8) TOTAL	(9) BTU x 10^6
JANUARY								
FEBRUARY								
MARCH								
APRIL								
MAY								
JUNE								
JULY								
AUGUST								
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

CHILLED WATER
PRELIMINARY ENERGY APPRAISAL

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EXPLANATORY NOTES

1.
(2) UNDER "TYPE" INDICATE WHETHER ORIFICE, POSITIVE DISPLACEMENT, TURBINE OR OTHER

(3) UNDER "UNITS" INDICATE PHYSICAL UNITS MEASURED BY METER

*ADJUST METER READINGS TO GIVE MONTHLY TOTAL

2.
(2)(4)(6)(8) IF METER MEASURES UNITS OTHER THAN BTUS ENTER IN BLANK COLUMNS.

(3)(5)(7)(9) ENTER SOURCE BTU

1. METERING: COST PER TON = _____ PER BTU x 10^6 _____
(1) (2) (3) (4) (5) (6) (7) (8)

METER NO.	TYPE	UNITS	AREAS SERVED	TEMPERATURE (°F)		PRESS PSIG	REMARKS
				INLET	RETURN		

2. CHILLED WATER RECEIVED
(1) (2) (3) (4) (5) (6) (7) (8) (9)

MONTH	METER NO.	BTU x 10^6	METER NO.	BTU x 10^6	METER NO.	BTU x 10^6	METER NO.	BTU x 10^6
JANUARY								
FEBRUARY								
MARCH								
APRIL								
MAY								
JUNE								
JULY								
AUGUST								
SEPTEMBER								
OCTOBER								
NOVEMBER								
DECEMBER								
TOTAL								

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

SUMMARY - BOUNDARY & SOURCE ENERGY

PRELIMINARY ENERGY APPRAISAL

FORM 3-1
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EXPLANATORY NOTES

(4)(5)(6)
- BUILDING BOUNDARY ENERGY IS ACTUAL ENERGY INPUT TO BLDG. TO BE USED FOR AN ENERGY BALANCE.
- IN CONSIDERING BLDG. BOUNDARY ENERGY, CHILLED WATER IS A NEGATIVE INPUT. IN THE ENERGY BALANCE IT IT EXTRACTS HEAT FROM THE BLDG.

(7)(8)(9)
- SOURCE BTUS ARE THE BTUS REQUIRED TO PRODUCE THE ENERGY ENTERING THE BLDG.
- IN CONSIDERING SOURCE ENERGY, CHILLED WATER IS POSITIVE INPUT. IT IS THE ENERGY REQUIRED TO PRODUCE THE CHILLFD WATER.

① REPRESENTS (HEAT OF STEAM) ÷ (HEAT OF CONDENSATE RETURN) USE SITE SPECIFIC FIGURE.

② REPRESENTS (FUEL INPUT) ÷ (STEAM DELIVERED TO AREAS REMOTE FROM STEAM GENERATING PLANT) USE SITE SPECIFIC FIGURE

③ THESE CONVERSION FIGURES ARE SITE SPECIFIC

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
			BUILDING BOUNDARY BTU			SOURCE BTU		
	ANNUAL USE	UNIT	CONVERSION FACTOR	BTU x 10^6 (2) x (4)	% TOTAL ENERGY	CONVERSION FACTOR	BTU x 10^6 (2) x (7)	%TOTAL ENERGY
NATURAL GAS		MCF	1.031			1.031		
FUEL OIL		GALS.	0.1387			0.1387		
LPG		GALS.	0.0955			0.0955		
COAL		TONS	24.58			24.58		
ELECTRICITY		KWH	3.413			11.6		
STEAM		LBS	①			②		
HOT WATER			③			③		
CHILLED WATER		TONS	③			③		
TOTALS								

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

SUMMARY - ENERGY COSTS

PRELIMINARY ENERGY APPRAISAL

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EXPLANATORY NOTES

- HEAD EACH COLUMN WITH THE TYPE OF ENERGY OR SERVICE SUPPLIED TO THE BLDG. (I.E. NATURAL GAS, FUEL OIL, LPG, COAL, STEAM, HOT OR CHILLED WATER, DOMESTIC WATER, ETC.)
- UNDER EACH TYPE INDICATE UNITS OF PHYSICAL MEASUREMENT WHEN AVAILABLE, FIRST AS MAX. DEMAND EACH MONTH, SECOND AS USAGE, THEN COST. UNDER COST INDICATE WHETHER THIS IS A DIRECT BILLED OR ALLOCATED CHARGE.
- UNDER COST TOTALS, SUMMARIZE FIGURES ON BOUNDARY AND SOURCE FROM FORM 3-1 PG. 11.

TYPE	ELECTRICITY											
UNITS / MONTH	KW	KWH	COST $ @$ /KWH									
JANUARY												
FEBRUARY												
MARCH												
APRIL												
MAY												
JUNE												
JULY												
AUGUST												
SEPTEMBER												
OCTOBER												
NOVEMBER												
DECEMBER												
TOTAL												
EQUIV. BTU/YR.	BLDG.		x 10^6 BTU									
	SOURCE		x 10^6 BTU									

POPE, EVANS AND ROBBINS

FORM 3-2

BASE BUILDING ENERGY APPRAISAL FORM

REF: SECTION 3B.4.5, Page 3-9, Vol. 1

PURPOSE: To assist in calculating the base building energy indices.

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BASE BUILDING ENERGY APPRAISAL FORM

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1. BASE BUILDING SPACE COOLING (For Human Comfort) EI_c — Inside ..... Outside .....

a. Gross Base Building Cooling Output: Area = ...SF_c; Summer Design ....

	(1) AREA SF	(2) TRANSMISSION (8) BTUH/SF/°F	(3) °F-TEMP (1) DIFFER	LOAD-BTUH (4)	BTUH/SF (5)	EFL$_c$ HRS/YR (6)	REFRIG OUTPUT BTU/SF$_c$/YR (7)
Skin Transmission							
Net Wall SF_w		0.15				(3)	=EI_w
Glass SF_g		0.54				(3)	=EI_g
Roof SF_r		0.068				(3)	=EI_r
Interior Walls SF_i							=EI_i
Total Transmission							=EI_t
Solar Gain							=EI_s
(2) Actual Occupancy SH = ... x .....Btu/Occ						(4)	=EI_{os}
Minimal Lighting & Receptacles = 2.0 W/SF x .....SF_c x 3.41 Btuh/W					6.83	(4)	=EI_{lr}
Subtotal (Transmission, solar, occupancy & lighting							
(9) Fan SH Loads (Supply & Return) = 0.5 W/SF_c x ..... SF_c x 3.41					1.71	(10)	=EI_f
Internal SH							
Actual Occupancy LH = ... x ..... Btu/Occ						(4)	=EI_{ol}
Internal TH							
(6) Vent SH = 1.08 (0.075 CFM/SF x .....SF_c (....-78) ΔF^o							=EI_{vs}
(7) Vent LH = 4840 (CFM)(-) ΔW						(5)	=EI_{vl}
Adjustment to Vent LH for Δ(Rm W attained and Design Rm W) =Vent LH = 4840(CFM)(-) ΔW						(5)	=EI_{vl}
Gross Base Building Design Cooling Load (Output for Building)							=EI_c
Internal Sensible Heat Factor = Internal SH/Internal TH						=	=ISHF
Required SA CFM = Internal SH/1.08 (T_r - T_c) =						=	=CFM_s

POPE, EVANS AND ROBBINS

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

BASE BUILDING ENERGY APPRAISAL FORM

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1. BASE BUILDING SPACE COOLING For Human Comfort (Cont'd) EI_c

a. Gross Base Building Cooling Output: (Cont'd)

NOTES:
(1) Design TD taken at 2 1/2% condition for dbt and 1% for wbt. Room = 78 dbt/50% RH
(2) Actual occupancy used - not subject to ECO
(3) Refer to Appendix 3 Table 3B-7 for Equivalent Full Load Cooling Hours taken for base building from dbt hourly occurrences between 0800 and 1700 hours for actual building climatic conditions.
(4) These figures are total hours of occurrence above 55°F ambient, since they represent 100% full load level during all hours of refrigeration. (i.e. no reduction with ambient temperature variation).
(5) Refer to Appendix 3 Table 3B-9 for EFL Hours for LH load of ventilation air derived from wbt hourly occurrences.
(6) Fill in design dbt from note (1)
(7) Fill in value of W from psychrometic chart for design wbt from note (1)
(8) Transmission Factors are as recommended by ASHRAE 90-75 Standard
(9) Fan Cooling energy load assumed for minimal-centralized air system requirements
(10) Fan EFL Hours based upon VAV system

b. Equipment Capacity Required

Design Load = /12,000 Btuh/Ton

c. Load Indices

	Calculated	Installed	Estimated or Metered Peak
1) Area Ratio: SF_c/Gross Tons =			
2) SA CFM Ratios: SA CFM/SF_c =			
SA CFM/Gross Tons=			

d. Building Cooling Energy Indices (EI_c)

Use conversion efficiencies appropriate for optimum source energy design for both building boundary and source

EI_c = Output EI_c/Conversion Eff

1) Base Building Input EI_c (Boundary) =

2) Base Building Input EI_c (Source) =

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

BASE BUILDING ENERGY APPRAISAL FORM

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2. BASE BUILDING SPACE HEATING (For Comfort EI_h Inside Outside

a. Net Base Building Heating Output: Area = SF_h; Winter Design ....

(1)	(2)	(3)	(4)	(5)	(6)	(7) ①	(8)
	AREA SF	TRANSMISSION BTUH/SF/°F	°F-TEMP DIFFER	LOAD-BTUH	BTUH/SF_h	EFL_h HRS/YR	HEATING OUTPUT BTU/SF_h/YR
① Skin Transmission							
Net Wall SF_w		0.15					$=EI_w$
Glass SF		0.54					$=EI_g$
Roof SF_r		0.068					$=EI_r$
Total Transmission							$=EI_t$
② Vent SH = 1.08 (CFM) ( )F°							$=EI_{vs}$
Total Heating Output							
Credits							
Net Heating Output							$=EI_h$

NOTES ① Refer to Appendix Table 3B-8 for EFL Heating Hours.

FACILITY: BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

BASE BUILDING ENERGY APPRAISAL FORM

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2. BASE BUILDING SPACE HEATING (Cont'd)

b. Equipment Peak Capacity Required (For Building Heat Generating Plants)
= Design Load (Btuh) x Pick-up Factor x Stand-by Factor, etc. = Btuh

c. Load Index - Peak Capacity (Btuh)/SF_h = $Btuh/SF_h$

d. Annual Heating Energy Index
Use conversion efficiencies appropriate for optimum design of actual heat generating cycles employed in the building for both boundary and source

Input EI_h = Output EI_h/Conversion Efficiency

1) Base Building Input EI_h (Boundary) = _____

2) Base Building Input EI_h (Source) = _____

3. BASE BUILDING SPACE HVAC ENERGY REQUIREMENTS (EI_{hvac}): Gross Building Area = SF_b

a. Boundary Basis:

$$\frac{(SF_c \times \text{Boundary } EI_c) + (SF_h \times \text{Boundary } EI_h)}{SF_b} = \text{_____} = Btu/SF_b/yr$$

b. Source Energy Basis:

$$\frac{(SF_c \times \text{Source } EI_c) + (SF_h \times \text{Source } EI_h)}{SF_b} = \text{_____} = Btu/SF_b/yr$$

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BUILDING ENERGY SURVEY AND APPRAISAL

BASE BUILDING ENERGY APPRAISAL FORM

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4. BASE BUILDING SERVICE HOT WATER ENERGY INDICES (EI_{hw}) For Human Comfort Area = SF_b

a. Service Hot Water Peak Demand:

For Office Buildings and others with light use (REF.1 Chapter 37)

1) Actual Occupancy = ...

2) Based upon 50°F to 140°F heating and 1.6 gal storage per occupant

3) Demand = $\frac{0.1 \text{ gal}}{\text{occ hr}} \times \frac{8.33 \text{ lb}}{\text{gal}} \times \frac{1 \text{ Btu}}{\text{lb °F}} \times 90F° =$ _____ Btuh/occ

or (Btuh/occ)(occ) ÷ (SF_b) = Btuh/SF_b

b. Annual Output Energy (Output EI_{hw})

$= \frac{365 \text{ gal}}{\text{occ yr}} \times \frac{8.33 \text{ Btu}}{\text{gal °F}} \times 90F° = 274{,}000$ Btu/occ/yr

or 274,000 (occ) ÷ (SF_b) = _____ Btu /SF_b

c. Annual Input Energy (Input EI_{hw})

Use efficiencies appropriate for optimum design of actual service hot water generators employed in the building for both boundary and source energy.

Input EI = Output EI_{hw}/Conversion Eff

1) Base Building Input EI_{hw}(Boundary)

= _____

2) Base Building Input EI_{hw}(Source)

= _____

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BASE BUILDING ENERGY APPRAISAL FORM

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5. BASE BUILDING NET ELECTRICITY (Not Generated in Building) (EI_e): Area = ...SF_b

a. Net Electrical Energy Consumption Schedule

(1)	(2)	(3) ④	(4)	(5)	(6) ⑥	(7) ⑦	(8)	(9) ⑦	(10)
	BASE AREA SF	DEMAND W/SF	DEMAND KW	EFL HRS/YR	CONSUMPTION KWH/YR	BOUNDARY ENERGY INPUT 10^3 BTU/YR	BOUNDARY ENERGY INPUT BTU/SF_b/YR	SOURCE ENERGY INPUT 10^3 BTU/YR	SOURCE ENERGY INPUT BTU/SF_b/YR
① Lights & Receptacles: Area 1									
Area 2									
Area 3									
Fans: For HVAC Supply & Return									
For General Exhaust									
② HVAC Auxiliaries: Cooling									
Heating									
③ General Building Services									
② Net Electric EI_e									

NOTES:
① Lighting includes indoor and outdoor lighting.
② Net Electric excludes the electric refrigeration energy already allowed for in EI_c. See Par 5b for total EI_e. HVAC auxiliaries, however are included here
③ The base building is assumed without electric heating of any kind (i.e. domestic hot water, space heating, heat pump). General Building Services should include all normal electrical functions which use electricity (i.e. elevators, sewage pumps) but no special or process functions.
④ Unit loadings (w/SF) apply to the particular area for which the guideline loading is given.
⑤ EFL hours taken for office building type, with 5 1/2 day regular occupancy, 2 hours/day cleaning. EFL Hours for HVAC cooling and heating areas should be derived for the specific climatic zone by prorating EFL_h and EFL_c over the 3000 basic hours of use per year. All after-hour heating is assumed without fan systems (i.e. radiation).
⑥ Energy Consumption (Kwh/SF_b/yr) for each function = (KW x EFL hours/yr)/SF_b.
⑦ Refer to Form 3-1 page 12 of 13 for Btu Equivalent Conversion Factor to use, or use appropriate site specific figures.

b. Total Electrical Consumption (EI_e) For reference only -- not for Par 6 totallization

1) Boundary EI_e (Total) = _____ Btu/SF_b/yr

2) Source EI_e (Total) = _____ Btu/SF_b/yr

FACILITY: BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

BASE BUILDING ENERGY APPRAISAL FORM

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6. BASE BUILDING ENERGY INDEX (EI_b)

Base $EI_b = EI_{hvac} + EI_{hw} + EI_e$ (net)

a. Boundary Input Basis

Base Boundary EI_b = Par 3a + Par 4c. 1) + Par 5a. Col (8)

= _____

b. Source Input Basis

Base Source EI_b = Par 3b + Par 4c. 2) + Par 5a. Col (10)

= _____

NOTES

1. There should be no duplication of energy input in the above figures.
2. Electricity, steam, chilled water and other secondary energy forms which are generated within the building from primary energy forms (e.g. electricity, from fuel, chilled water from electricity) must not be included in an EI node if its parent form of energy appears in another EI node.

FORM 3-3

ACTUAL BUILDING ENERGY APPRAISAL FORM

REF: SECTION 3B.4.6, Page 3-11, Vol. 1

PURPOSE: To assist in calculating actual building energy consumption and indices.

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ACTUAL BUILDING ENERGY APPRAISAL FORM

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1. ACTUAL BUILDING SPACE COOLING (For Comfort or Process)⑤ EI_c

a. Net Actual Building Cooling Output: Area = ... SF_c; Summer Design Inside ..... Outside .....

	(1) AREA SF	(2) TRANSMISSION BTUH/SF/°F	(3) °F-TEMP DIFFER	(4) LOAD-BTUH	(5) BTUH/SF_c	(6) EFL_c HRS/YR	(7) REFRIG OUTPUT BTU/SF_c/YR
① Skin Transmission							
Net Wall SF_w							$=EI_w$
Glass SF_g							$=EI_g$
Roof SF_r							$=EI_r$
Interior Walls SF_i							$=EI_i$
Total Transmission							$=EI_t$
Solar Gain							$=EI_s$
Actual Occupancy SH = ... x .....Btu/Occ							$=EI_{os}$
Actual Lighting & Receptacles ..... kw x 3,413 Btu/kw							$=EI_{lr}$
③ Internal Process SH Loads							$=EI_{ps}$
Subtotal (Transmission, solar, occupancy, lighting & process)							
② Actual Fan SH Loads (Supply & Return)							$=EI_f$
Internal SH							
Actual Occupancy LH							$=EI_{ol}$
Process LH Loads							$=EI_{pl}$
Internal TH							
① Vent SH = 1.08 (CFM) (-)Δ F°							$=EI_{vs}$
Vent LH = 4840 (CFM) (-)Δ W							$=EI_{vl}$
Adjustment to Vent LH for Δ (Rm W attained and Design Rm W)							
=Vent LH = 4840(CFM) (-)Δ W							$=EI_{vl}$
Net Calculated Cooling Load (Output for Building)							$=EI_c$
Internal Sensible Heat Factor = Internal SH/Internal TH =						=	$=ISHF$
Required SA CFM = Internal SH/1.08 (T_r - T_c) =						=	$=CFM_s$
Actual S.A. CFM (Form 4-1, Pg. 15, Column 6, HVAC Total for cooling units only)							$=CFM_s$

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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1. ACTUAL BUILDING SPACE COOLING (Cont'd)

a. Net Actual Building Cooling Output (Cont'd)

NOTES for Par. 1.a Tabulation

① Use actual transmission factors, ΔF, ΔW, design conditions and EFL hrs. as dictated by building process or function.
② Include all fan heat which becomes a cooling load.
③ If any internal SH loads are known to be neutralized by process coolant or refrigeration systems, the net rather than gross process heat gain should be used.
④ If individual areas have substantially different operating periods for room design conditions, cooling, fan operation or process, etc., or ventilation rates are not constant, or vary in different proportions from air unit to air unit, such load components should be separately calculated and totalized for each component, with pertinent EFL Hrs. for each.
⑤ Use separate appraisal forms for distinctly separable process and comfort space cooling systems.

b. Gross Peak Output Cooling Load (Calculated)=Net Output Load (Par.1.a.) + Excess or Penalty Loads

1) Net Calculated Load Output = .../12,000 = _____.....Tons (net)
2) Supplementary Heat Gains _____.....
3) Penalty Load ⑥ _____ + _____
4) Actual Gross Output Load (Calculated) .....Tons(Gross)

NOTES ⑥ Penalty loads are those in excess of net cooling energy requirements by virtue of system characteristics (e.g. cooling load reheat at system peak for rooms below their individual, non-coincident, peak load).

c. Equipment Capacities (Survey Data)

1) Installed .....Tons
2) In Service.....Tons

d. Load Indices:

	Calculated	Installed	Estimated or Metered Peak
1) Area Ratio: SF_c/Gross Tons =			
2) SA CFM Ratios: SA CFM/SF_c =			
SA CFM/Gross Tons =			

FACILITY BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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1. ACTUAL BUILDING SPACE COOLING (Cont'd)

e. Gross Cooling Output Load and Energy Reconciliation.
Estimated or metered breakdown by type of refrigeration input energy. If metered, refer to appropriate form. If not, estimate as follows from field survey or operating hours and load profiles of each type of refrigeration cycle. Reconcile total peak tons with that in Par. 1 b and the appropriate Form 3-4 energy synthesis tabulations.

(1)	(2)	(3)	(4)	(5)	(6)	(7)
REFRIG. UNIT	ENERGY TYPE	CAPACITY-TONS NOMINAL	CAPACITY-TONS PEAK	TOTAL HOURS OF OPERATION	LOAD FACTOR	ACTUAL OR ESTIMATED OUTPUT TON-HRS/YR
TOTALS	Installed					
	In Service					
	Actual Loads					

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BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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1. ACTUAL BUILDING SPACE COOLING (Cont'd)

f. Building Cooling Energy Indices. (EI_c)

(1)	(2) ①	(3)	(4) ②③	(5) ②	(6) ②③	(7) ②
TYPE REFRIGERATION DRIVE	OUTPUT IN TON-HRS/YR	OUTPUT IN PHYS UNITS/YR	BOUNDARY ENERGY INPUT 10^6 BTU/YR	BOUNDARY ENERGY INPUT BTU/SF_c/YR	SOURCE ENERGY INPUT 10^6 BTU/YR	SOURCE ENERGY INPUT BTU/SF_c/YR
(1) Steam Turbine Refrigeration Drive		lbs				
(2) Steam or Hot Water Absorption Refrigeration						
(3) Electric Refrigeration Drive		④ kwh				
(4) Gas Turbine Refrigeration Drive		Mcf				
(5) Diesel Engine Refrigeration Drive		Gal				
TOTALS						

NOTES
① Col (2) taken from total of Table 1e Col (7)
② Figures in Col (4) to (7) must reconcile with those in Form 3-4, Pgs 1 to 6
③ Use appropriate conversion factors for Cols (4) and (6)
④ Item (3) Col (3) must equal item c(1) in Par 6 (to avoid duplication of electric energy input in EI_b)

FACILITY: BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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2. ACTUAL BUILDING SPACE HEATING (For Comfort or Process) EI_h

a. Net Actual Building Heating Output: Area = SF_h; Winter Design Inside ..... Outside .....

	(1)	(2) AREA SF	(3) TRANSMISSION BTUH/SF/°F	(4) °F-TEMP DIFFER	(5) LOAD-BTUH	(6) BTUH/SF_h	(7) EFL_h HRS/YR	(8) HEATING OUTPUT BTU/YR	(9) HEATING OUTPUT BTU/SF_h/YR
1)	Skin Transmission								
	Net Wall SF_w								$=EI_w$
	Glass SF								$=EI_g$
	Roof SF_r								$=EI_r$
	Total Transmission								$=EI_t$
2)	Vent SH = 1.08 (CFM) ( )ΔF^o								$=EI_{vs}$
	Total Heating Output								
3)	Credits								
	Net Heating Output								$=EI_h$

NOTES
① Use actual transmission factors, ΔF, design conditions and EFL hours as dictated by building process or function.
② If individual areas have substantially different operating periods for room design conditions, ventilation quantities or temperature lift, etc., such load components should be separately calculated with pertinent EFL hours and totalized for each load component.
③ Only legitimate credits should be taken, when internal heat gains are determined to be effective in either perimeter areas (with heat losses); in air streams (i.e. heat of light added to return air streams when such captured heat is effectively utilized and not neutralized by outside air mixing or refrigeration); in interior areas when the outside air component of supply air is warmed from the cold supply temperature to room condition; or for other specific system characteristics.
④ Use separate appraisal form for distinctly separable comfort and process space heating systems.

2. ACTUAL BUILDING SPACE HEATING (Cont'd)

b. Gross Peak Output Heating Load
= Net Output Load (Par 2a) + Excess Penalty Loads

		Btuh	lb/hr
1)	Net Calculated Output Load	.....Btuh	.....lb/hr
2)	Penalty Load ⑤		
3)	Actual Gross Output Load	Btuh	lb/hr

c. Equipment Capacities:

1) Installed _____

2) In Service _____

d. Load Index

	Calculated	Installed	Estimated or Metered Peak
Gross Output/SF_h =			

NOTE ⑤ Penalty loads are those in excess of net heating energy requirements by virtue of system characteristics (e.g. perimeter radiation scheduled for capacity greater than required to satisfy the transmission loss, when supply air is introduced to the perimeter areas at below room temperature and it is produced from a blend of outside air in excess of the minimum required for cooling).

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BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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2. ACTUAL BUILDING SPACE HEATING (Cont'd)

e. Gross Heating Output Load, Energy Reconciliation, and Indices (EI_h)
Estimated or metered breakdown by type of heating input energy. If metered, refer to appropriate Form. If not, estimate from field survey of operating hours and load profiles of each heating mode. Reconcile total of peak load (Btuh) with that in Par 2b and the appropriate Form 3-4 energy synthesis tabulations.

(1)	(2) ① IN PHYSICAL UNITS		(3)	(4)	(5) ②	(6) BOUNDARY ENERGY INPUT		(7) SOURCE ENERGY INPUT	
HEATING MODE	PEAK LOAD		TOT HRS OPER	LOAD FACT	OUTPUT IN PHYS UNITS/YR	10^6BTU/YR	BTU/SF_h/YR	10^6BTU/YR	BTU/SF_h/YR
(1) Fuel Oil		Gal							
(2) Gas		Mcf							
(3) Steam or H.W.		Lbs							
(4) Electricity	③	Kw							
(5) TOTALS									

NOTES
① Col (2) from data in Forms 3-4 for each energy type applied to space heating
② Col (5) total must equal that in Par 2b3
③ Item (4), Col (1) must equal item c (2) in Par (6) to avoid duplication of electrical energy input in EI_e

3. ACTUAL BUILDING SPACE HVAC INDICES (EI_{hvac}): Building Area = ... SF_b

a. Boundary Basis:

$$\frac{(SF_c \times \text{Bdry } EI_c) + (SF_h \times \text{Bdry } EI_h)}{SF_b} = \_\_\_\_\_ = \_\_\_\_\_ = \text{Btu/}SF_b\text{/yr}$$

b. Source Energy Basis:

$$\frac{(SF_c \times \text{Source } EI_c) + (SF_h \times \text{Source } EI_h)}{SF_b} = \_\_\_\_\_ = \_\_\_\_\_ = \text{Btu/}SF_b\text{/yr}$$

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4. ACTUAL BUILDING SERVICE HOT WATER ENERGY INDICES (EI_{hw})(For Comfort or Process): Area = ...SF_b

a. Derive total annual hot water consumption by one of the following methods (gal/yr):

1) Direct metering of H.W. to heaters
2) Estimated % of metered cold water consumption, from field survey.
3) Calculated by occupancy (see Form 3-2 Par 4)

b. Energy Output from Par 4a (1), (2) or (3) data:

(gal/yr) x (8.33 Btu/gal ^oF) x (F^o) = Btu/yr

c. Energy Input Schedule and Indices

(1)	OUTPUT REQUIREMENTS 10^6 BTU/YR	(2) ① TOTAL ENERGY INPUT 10^6 BTU/YR	(3) ① TOTAL ENERGY INPUT KWH/YR	(4) ① BOUNDARY ENERGY INPUT 10^6 BTU/YR	(5) BOUNDARY ENERGY INPUT BTU/SF_b/YR	(6) SOURCE ENERGY INPUT 10^6 BTU/YR	(7) SOURCE ENERGY INPUT BTU/SF_b/YR
(1) Fuel							
(2) Steam or H.W.							
(3) Electricity			②				
(4) TOTAL							

NOTES
① The relevant quantities in Cols (2), (3), or (4) must reconcile with those in Forms 3-4 pertaining to each type of energy.
② Item 3, Col (3) must equal item c3 in Par 6 (to avoid duplication of electric energy in EI_b)

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ACTUAL BUILDING ENERGY APPRAISAL FORM

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5. ACTUAL NET BUILDING PROCESS (EI_p): Area = ...SF_b

a. All types of process electric, heat or fuel energy appearing in Tables 1a and 2a reflect only the thermal heat gains or credits in the HVAC systems, not the consumption of each form for Energy Index totalization. (e.g. process EI_{ps} in EI_c only determines the refrigeration required to absorb the process heat gain, but does not reflect the consumption of process steam or electricity by the building). Therefore these values must be included in this tabulation of various energy types for completion of building energy consumption.

b. Conversely, only process energy appearing in Tables 1f, 2e, 4c or 6d for EI_c, EI_h, EI_s or EI_e are automatically accounted for and should not be duplicated in this table.

c. The intent of this tabulation is to identify process energy nodes whose magnitude can be specifically identified by metering or rational calculations, and not included elsewhere.

d. Energy Input Schedule & Indices

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
ENERGY TYPE	FUNCTION	CONSUMPTION PHYSICAL UNITS	TOT HRS OPER	LOAD FACT	OUTPUT 10^6BTU/YR	BOUNDARY ENERGY INPUT		SOURCE ENERGY INPUT	
						10^6BTU/YR	BTU/SF_b/YR	10^6BTU/YR	BTU/SF_b/YR
(1) Fuel Oil		Gal							
(2) Gas		Mcf							
(3) Steam		Lbs							
(4) Hot Water									
(5) Electric		Kwh							
(6) Net EI_p									①

NOTES ① This EI_p is not the total process Energy Index for the building

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BUILDING ENERGY SURVEY AND APPRAISAL

ACTUAL BUILDING ENERGY APPRAISAL FORM

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6. ACTUAL NET BUILDING ELECTRICITY (Not Generated in Building) (EI_e): Area = ...SF_b

a. All electrical energy appearing in Tables 1a and 2a reflect only the thermal heat gain or credit in the HVAC systems, not the consumption for Energy Index totalization (e.g. lighting EI_{lr} in EI_c only determines the refrigeration required to absorb the lighting heat gain, but does not reflect the consumption of electricity by the building). Therefore these values must be included in this tabulation of various energy consumers for completion of building energy consumption.

b. Conversely, only electrical energy appearing in Tables 1f, 2e, 4c or 5d, for EI_c, EI_h, EI_{hw} or EI_p is automatically accounted for and should not be duplicated in this table.

c. Net Consumption Derivation: Total Building Consumption (Form 3-4, Page 5, Col 6 total) = kwh/yr

(1) Less: Electric Refrig: Par 1f, item (3) Col (3) .....
(2) Electric Heating: Par 2e, item (4) Col (1) .....
(3) Electric Svce H.W.: Par 4c, item (3) Col (3).....
(4) Electric Process: Par 5d, item (5) Col (4) _____

Less Subtotal (_____)

Net KWH/YR for other Electrical functions (Table 6d, below) .....kwh/yr

d. Net Electrical Energy Consumption Schedule (Reconcile with Form 3-4 Pg 5)

	(1) ACTUAL DEM KW	(2) ACTUAL DEM W/SF_b	(3) CONSUMPTION KWH/YR	(4) BOUNDARY ENERGY INPUT 10^6 BTU/YR	(5) BOUNDARY ENERGY INPUT BTU/SF_b/YR	(6) SOURCE ENERGY INPUT 10^6 BTU/YR	(7) SOURCE ENERGY INPUT BTU/SF_b/YR
(1) Lights & Receptacles							
(2) Fans: For HVAC S & R — Comfort							
(3) Fans: For HVAC S & R — Process							
(4) Fans: For Exhaust — General							
(5) Fans: For Exhaust — Process							
(6) Process Refrigeration:							
(7) Auxiliaries: For HVAC — Cooling							
(8) Auxiliaries: For HVAC — Heating							
(9) Auxiliaries: For Process Refrigeration							
(10) Other Process Electric							
(11) General Building Services							
(12) Net Electric EI_e							

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ACTUAL BUILDING ENERGY APPRAISAL FORM

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6. ACTUAL NET BUILDING ELECTRICITY (Not Generated in Building) (EI_e) (Cont'd)

e. For reference only (not for Building Energy Index totalization of Par 7), Total EI_e from total building electrical consumption (item 6c):

(1) Boundary EI_e (Total) = ... $Btu/SF_b/Yr$

(2) Source EI_e (Total) = ... $Btu/SF_b/Yr$

7. ACTUAL BUILDING ENERGY INDEX

Actual $EI_b = EI_{hvac} + EI_{hw} + EI_p + Net\ EI_e$

a. Boundary Input Basis
Actual Boundary EI_b = Par (3a + 4c Col 5 + 5d Col 9 + 6d Col 5)
= _____

b. Source Input Basis
Actual Source EI_b = Par (3b + 4c Col 7 + 5d Col 11 + 6d Col 7)
= _____

NOTES

① There should be no duplication of energy input in the above figures.

② Electricity, steam, chilled water and other secondary energy forms which are generated within the building from primary energy forms (e.g. electricity, from fuel, chilled water from electricity) must not be included in an EI node if its parent form of energy appears in another EI node.

FORM 3-4

ENERGY FLOW DIAGRAM SYNTHESIS FORMS

REF: SECTION 3B.4.7, Page 3-14, Vol. 1

PURPOSE: To assist in synthesizing energy information from the actual building energy appraisal for reconciliation with actual building meter and record data. Final data to be used in energy flow and balance diagram.

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BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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1. NATURAL GAS

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONVERSION DEVICE		TYPE SERVICE	ACTUAL DEMAND		OPER HRS/YR	LOAD FACTOR	BOUNDARY ENERGY =		SOURCE ENERGY	CONTINUING ENERGY SYSTEM
IDENT	TYPE		CFH	10^3 BTUH			MCF/YR	10^6 BTU/YR	BTU/SF_b/YR	
G										
G										
G										
G										
G										
TOTALS					AVGE	AVGE				

NOTES

1. Col (1) key each line item to subsequent energy system forms and Flow Diagram by Identification No. and Continuing Energy Systems in Col. (11). If none, leave blank.
2. Col. (2): indicate type i.e. diesel (G_d) or turbine engine generator (G_{tg}) steam (G_s) or hot water generator (G_{hw}), furnace (G_f), etc.). Group together devices of same type and service. Use descriptive subscripts to designate each type of device.
3. Col. (3): indicate "H" for human comfort service, "P" for process and list device separately when service or conversion product and its quanities can be separately identified by meter, calculation or estimate guideline.
4. Col. (4): metered, or projected from equipment ratings and demand factors, in cubic feet per hour (CFH)
5. Col. (9): calculated from Col. (5) x (6) x (7), or metered. Indicate "M" if metered.
6. Reconcile Col. (8) Total with annual gas consumption - Form 3-1, Pg. 1.
7. Use conversion factors same as SITE ENERGY HANDBOOK, or as specifically appropriate for the building.

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BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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BY

2. FUEL OIL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONVERSION DEVICE		TYPE	ACTUAL	DEMAND	OPER	LOAD	BOUNDARY ENERGY = SOURCE ENERGY			CONT'G
IDENT	TYPE	SVCE	GPH	10^3 BTUH	HRS/YR	FACTOR	GAL/YR	10^3BTU/YR	BTU/SF_b/YR	ENERGY SYSTEM
FO										
FO										
FO										
FO										
FO										
TOTALS					AVGE	AVGE				

NOTES

1. Col (1) key each line item to subsequent energy system forms and Flow Diagram by Identification No. and Continuing Energy Systems in Col. (11). If none, leave blank.
2. Col. (2): indicate type i.e. diesel or turbine engine generator (FO_d or FO_{tg}) steam (FO_s) or hot water generator (FO_{hw}), furnace (FO_f), etc.). Group together devices of same type and service. Use descriptive subscripts to designate each type of device.
3. Col. (3): indicate "H" for human comfort service, "P" for process and list device separately when service or conversion product and its quanities can be separately identified by meter, calculation or estimate guideline.
4. Col. (4): metered, or projected from equipment ratings and demand factors, gallons per hour.
5. Col. (9): calculated from Col. (5) x (6) x (7),or metered. Indicate "M" if metered.
6. Reconcile Col. (8) Total with annual F.O. consumption - Form 3-1 Pg. 2.
7. Use conversion factors same as SITE ENERGY HANDBOOK, or as specifically appropriate for the building.

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BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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BY:

3. LPG

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONVERSION DEVICE		TYPE	ACTUAL	DEMAND	OPER	LOAD	BOUNDARY ENERGY =		SOURCE ENERGY	CONTINUING
IDENT	TYPE	SERVICE	GPH	10^3BTUH	HRS/YR	FACTOR	GAL/YR	10^3 BTU/YR	BTU/SF_b/YR	ENERGY SYSTEM
LPG										
LPG										
LPG										
LPG										
LPG										
TOTALS					AVGE	AVGE				

NOTES

1. Col (1) key each line item to subsequent energy system forms and Flow Diagram by Identification No. and continuing energy systems in Col. (11). If none, leave blank.
2. Col. (2): indicate type i.e. diesel or turbine engine generator (LPG_d or LPG_{tg}) steam (LP_s) or hot water generator (LPG_{hw}), furnance (LPG_f), etc.). Group together devices of same type and service. Use descriptive subscripts to designate each type of device.
3. Col (3): indicate "H" for human comfort service, "P" for process and list device separately when service conversion product and its quantities can be separately identified by meter, calculation or estimate guideline.
4. Col. (4): metered, or projected from equipment ratings and demand factors.
5. Col. (9): calculated from Col. (5) x (6) x (7), or metered. Indicate "M" if metered.
6. Reconcile Col. (8) Total with annual LPG consumption - Form 3-1, Pg. 3.
7. Use conversion factors same as SITE ENERGY HANDBOOK, or as specifically appropriate for the building.

FACILITY: BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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BY

4. COAL

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
CONVERSION DEVICE		TYPE SERVICE	ACTUAL SHORT TONS	DEMAND 10^3 BTUH	OPER HRS/YR	LOAD FACTOR	BOUNDARY ENERGY = SOURCE ENERGY			CONTINUING ENERGY SYSTEM
IDENT	TYPE						TONS/YR	10^3 BTU/YR	BTU/SF_b/YR	
TOTALS					AVGE	AVGE				

NOTES

1. Col. (1): key each line item to subsequent energy system forms and Flow Diagram by Identification No. and Continuing Energy Systems in Col. (11). If none, leave blank.
2. Col. (2): indicate type of boiler. Group together devices of same type and device. Use descriptive subscripts to designate each type of device.
3. Col. (3): indicate "H" for human comfort service, "P" for process and list device separately when service or conversion product and its quantities can be separately identified by meter, calculation or estimate guideline.
4. Col. (4): metered, or projected from equipment ratings and demand factors.
5. Col. (9): calculated from Col. (5) x (6) x (7), or metered. Indicate "M" if metered.
6. Reconcile Col. (8) Total with annual coal consumption.
7. Use conversion factors same as SITE ENERGY HANDBOOK.

FACILITY BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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BY

5. ELECTRICITY
a. For Reconciliation By Energy Systems

(1) IDENT	(2) CONVERSION DEVICE OR FUNCTION TYPE		(3) COINCIDENT ACTUAL DEMAND KW	(4) HOURS/YR OPER	(5) HOURS/YR EFL	(6) LOAD FACT	(7) BOUNDARY ENERGY INPUT KWH/YR	(8) BOUNDARY ENERGY INPUT 10^6BTU/YR	(9) BOUNDARY ENERGY INPUT BTU/SF_b/YR	(10) SOURCE ENERGY INPUT 10^6BTU/YR	(11) SOURCE ENERGY INPUT BTU/SF_b/YR	(12) CONTINUING ENERGY SYSTEMS
E_{lr}	Ltg-Rec											
Erc	Refrig	Comfort										
E_{rp}		Process (Demin)										
E_{hc}	Space Htg	Comfort										
E_{hp}		Process										
E_{sc}	Service H.W.	Comfort										
E_{sp}		Process										
	Fans											
E_{fhc}	HVAC S & R	Comfort										
E_{fhp}		Process										
E_{feg}	Exhaust	General										
E_{fep}		Process										
E_{ac}	Auxil.	Cooling										
E_{ah}	For HVAC	Heating										
E_{ap}	For Process Refrig.											
E_p	Other Process											
E_b	General Bldg. Svce											
	TOTAL											

NOTES
1. Use separate sheet for on site power generation and identify accordingly.
2. Col. (3): Projected from equipment connected loads and demand factors, metered, or by reconciliation.
3. Col. (5): Assumed or (7)/(3) Col.(6)=(7)/(3) x (4) or Col.(5)/(4)
4. Col. (7): Col. (3) x (5) or metered. Indicate 'M' if metered. Reconcile with Form 3-3 figures.
5. Col.(8) & (10): See SITE ENERGY HANDBOOK FORM E3-3 for Btu Equivalent Conversion Factor.
6. Reconcile total of Col. 7 with annual electrical consumption Form 3-1, Pg. 5.
7. If process and comfort functions are not distinct, show combined figure with bracket. Figure should include all apparatus not in foregoing classifications.

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BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY FLOW DIAGRAM SYNTHESIS

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5. ELECTRICITY
b. For Reconciliation by Space Function

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)
SPACE FUNCTION	AREA SQ FT	LTG W/SF	RECP W/SF	TOTAL OF LTG & RECP W/SF	TOTAL OF LTG & RECP KW	EQUIP LOAD KW	CON-NECTED LOAD KW	DEMAND FACTOR %	PEAK NON COINC KW	COINC-IDENCE FACTOR %	COINC DEMAND KW	LOAD FACTOR %	HRS/YR OPER	ENERGY USE KWH/YR
Offices														
Off/Labs														
Labs														
Conference														
Meeting														
Library														
Storage														
Corr-Stair														
Service Area														
Storage														
Equipment Rm.														
TOTAL														

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ENERGY FLOW DIAGRAM SYNTHESIS

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BY

6. STEAM

(1) IDENT	(2) CONVERSION DEGRADATION PROCESS TYPE	(3) ACTUAL DEMAND LB/HR	(4) HRS/YR OPER	(5) HRS/YR EFL	(6) LOAD FACT	(7) BOUNDARY ENERGY INPUT LB/YR	(8) BOUNDARY ENERGY INPUT 10^6BTU/YR	(9) BOUNDARY ENERGY INPUT BTU/SF_b/YR	(10) SOURCE ENERGY INPUT 10^6 BTU/YR	(11) SOURCE ENERGY INPUT BTU/SF_b/YR	(12) KEYS TO ENERGY SYSTEM FLOW ORIGIN	(13) KEYS TO ENERGY SYSTEM FLOW CONTINUING
	Power:											
S_{pe}	Electricity											
S_{pd}	Drives											
	Refrig:											
S_{rc}	Comfort											
S_{rp}	Process											
	Air Handlers:											
S_{ac}	Comfort											
S_{ap}	Process											
S_{rad}	Radiation HW & Steam											
	Service Hot Water:											
S_{dhw}	Domestic											
S_{phw}	Process											
S_{shw}	Space Htg(Hot Water)											
S_p	Other Process											
	TOTAL	COINC PEAK										

NOTES
1 Cols. (12) & (13): key each line item to originating and continuing forms of energy.
2 Col (3): metered or projected from equipment ratings demand factors or guideline calculations.
3 Col (7): Col (3) x (5) or metered. Reconcile with related figures in Form 3-3 (e.g. $S_{ac} + S_{ap} + S_{rad} + S_{shw}$ must total same as line (3) Form 3-3 Table 2e). Indicate 'M' if metered.
4 Cols (8) & (10): Refer to SITE ENERGY HANDBOOK for Btu conversion factors, or use specific appropriate ones.
5 S_{pe} and S_{pd} include all turbines for electric generation and equipment exclusive of refrigeration.
6 S_{rc} and S_{rp} include all turbine drives for refrigeration.
7 S_{ac} and S_{ap} include all fan-powered HVAC devices (i.e. cooling, heating, H&V, UV, fan-coil, etc.).
8 If turbines are exhausted or extracted, Col (13) should show identification Key to the subsequent energy node (i.e. S_{rp}). Cols (7) to (11) should identify and include these quantities but they should be encircled and not included twice in the totals.

CHAPTER 4

IN-DEPTH SURVEY AND APPRAISAL OF SELECTED ECOs

FORM 4-1

IN-DEPTH SURVEY FORMS

REF: SECTION 4B.2.1, Page 4-2, Vol. 1

PURPOSE: To assist in the collection of ECO oriented data during the final In-Depth Survey. It is not intended that all these forms be used in each building. Pertinent forms should be selected for energy systems with likely ECOs and for possible ECOs identified during previous stages of building survey. The forms should be refined to take into account particular local conditions. Also, new forms may have to be developed for special energy systems not covered herein. Refer to Appendix 1, ECO Related Questions, to help develop new and refine existing In-Depth Survey Forms.

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BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH ENERGY SURVEY FORM

BUILDING NAME.....

BUILDING FEATURES

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A. PHYSICAL BUILDING CHARACTERISTICS BUILDING NO.....

1. TYPE..... 2. FUNCTIONS.....

3. NO. OF STORIES..... ALTITUDE..... AGE.....

4. GLASS: MFR..... SINGLE..... DOUBLE..... REFLECTIVE..... HT. ABS..... COLOR.....

5. SHADING: OUTSIDE FINS..... OVERHANG..... OTHER..... INSIDE SHADES..... BLINDS.....
DRAPES.....

6. MAJOR WALLS: CONSTR..... DENSITY/CF..... U FACTOR.....

7. ROOF: CONSTR..... DENSITY/CF..... U FACTOR.....

8. SHADING - TIME AND DURATION:.....

9. OTHER NOTES.....
.....

B. AREA SF

	FLOOR AREAS EACH	FLOOR AREAS TOTALS	EXTERIOR GROSS SKIN AREA (WALL+GLASS)* N	E	S	W	TOTALS
BSMT.							
FLOOR...TO.....							
FLOOR...TO.....							
FLOOR...TO.....							
ROOF....TO.....							
TOTALS.....							

*MARK ANY WALLS NOT EXPOSED

1. GLASS AREA ....
2. NET WALL AREA= GROSS-GLASS ....
3. TOT. AREAS: COOLED..... HEATED..... UNHEATED.....
4. SPECIAL AREAS (INCLUDED IN ABOVE TOTALS)

FUNCTION	SF	HEAT	COOL	FLOOR	COMMENTS
.....					.....
.....					.....
.....					.....
.....					.....

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH ENERGY SURVEY FORM

BUILDING FEATURES

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C. BUILDING COMFORT, USE & OCCUPANCY

1. HVAC DESIGN CRITERIA

OUTSIDE: SUMMER..... DBT/..... WBT WINTER..... DBT.....MPH

INSIDE: SUMMER..... DBT/.....WBT WINTER.....DBT DAY .....DBT NITE

WINTER HUMIDITY CONTROL - MINUMUM .....% RELATIVE HUMIDITY

MINIMUM SUPPLY AIR CFM/SF..... OFFICES,..... .....

MINIMUM OUTSIDE AIR CFM/SF..... OFFICES,..... .....

SPACE	OFFICES						
NO. OCCUPANTS	.....	.....	.....	.....	.....	.....	.....
ACTIVITY	.....	.....	.....	.....	.....	.....	.....

2. MODE OF USE

REGULAR OCCUPANCY (HRS/DAY): WEEKDAYS..... SUNDAYS..... SATURDAY..... HOLIDAYS.....

HOLIDAYS/YR.....; EXTRA HRS/DAY CLEANING.....; .....% FULL LOAD LIGHTS; .....%FULL LOAD EQUIP.

EQUIPMENT OR LIGHTS DURING OTHER HOURS:

ITEM	ADD'TL HRS/DAY	% FULL LOAD
.....	.....	.....
.....	.....	.....
.....	.....	.....

TIMETABLE OF BUILDING OPERATION WITH RESPECT TO LIGHTING, HVAC, DOMESTIC WATER (HOT OR COLD), AND PROCESS EQUIPMENT. USE DAILY PROFILE CURVES IF NECESSARY FOR CLARITY.

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH ENERGY SURVEY FORM

BUILDING FEATURES

FORM: 4-1
PAGE 3 OF 19
DATE:
BY _____

3. EVALUATION OF COMFORT ACTUALLY ATTAINED:

4. WEATHER DATA - HOURLY OCCURRENCES - 5 DEGREE INTERVALS:

TO:	(-20^0)	(-15^0)	(-10^0)	(-5^0)	0^0	10^0	15^0	20^0	25^0	30^0	35^0	40^0
HRS:												

TO:	45^0	50^0	55^0	60^0	65^0	70^0	75^0	80^0	85^0	90^0	95^0	100^0
HRS:												

HEATING DEGREE HOURS_____ COOLING DEGREE HOURS_____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH ENERGY SURVEY FORM

BUIDING FEATURES

FORM: 4-1
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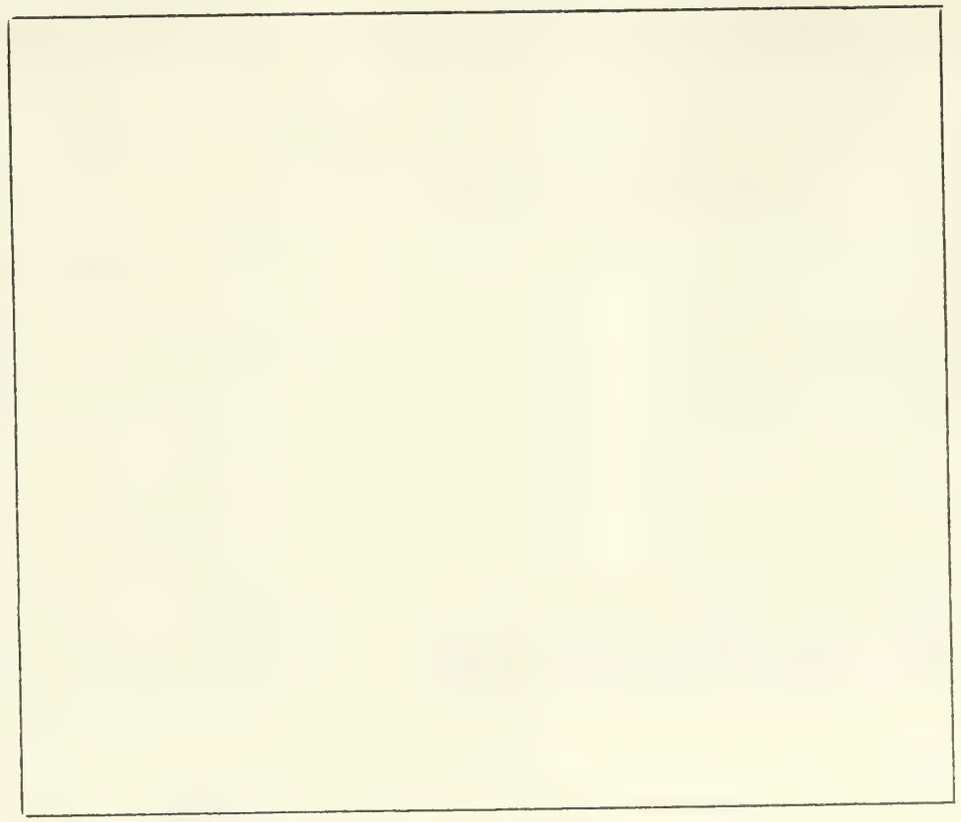


SKETCH-ORIENTATION-EXPOSURE-SHADING
USE ISOMETRIC FOR IRREGULAR BLDGS.

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH SURVEY FORM

E2 HEAT GENERATING PLANT

FORM 4-1
PAGE 5 OF 19
DATE:
BY: _____

HEAT GENERATING PLANT

1. Function: Space heating____ Dom.water heating____ Describe process or other:

2. Fuel: Single____ or Dual____ Interruptable____ Off-peak____ Fuel 1____
Fuel 2____ Fuel 3____ Firing is remote____ Bldg served with_____
Electric Fired____

3. Type: Furnace____ Boiler____ Central____ Unitary____ Room space heaters____

4. Schedule of Heat Generators

5.

(1) Unit No.	(2) Furnace Mfr	(3) Model	(4) Fuel & Input	(5) CFM	(6) (7) Temp. °F In	Out	(8) MHP	(9) TSP"	(10) Remarks
F-1									

(1) Unit No.	(2) Boiler Mfr	(3) Model	(4) Fuel & Input	(5) Gross Output Mbh	(6) lbs/hr	(7) Steam psig	(8) °F	(9) Hot Water In	(10) Out	(11) Remarks
B-1										

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH SURVEY FORM

E2 HEAT GENERATING PLANT

FORM 4 -1
PAGE 6 OF 19
DATE:
BY: _____

HEAT GENERATING PLANT (cont'd)

If electric "fired" indicate whether resistance or electrode type, also KW under Fuel. If heat source is from waste, define its nature and feeding rate under fuel and comments. Tabulate below, for each unit, the type furnace (warm air, direct, indirect), type boiler (horizontal or vertical fire tube or water tube, Scotch, sectional C.I., packaged) type draft (natural, forced, induced) type burner (mechanical, pressure steam, air or rotary cup atomizing); basic control mode and sequencing order for appropriate plant load; area or process served.

_____

_____

_____

_____

_____

_____

6. Other Major Plant Equipment Auxiliaries

1. Heat Distribution Apparatus: See "Steam or Hot Water Distribution" forms
2. Heat Utilization Apparatus: See various "System" forms
3. Prime Movers: Steam Turbine____ Internal Combustion____
4. Oil Storage: (Grade, size, quantity, under or above ground, heating method)

_____

5. Fuel Oil Supply System: (Mfr, qty, type, size of pumping & htg. equipment)

_____

6. Boiler Feed System: _____

_____

EXPLANATORY NOTES	FACILITY: BUILDING:
	BUILDING ENERGY SURVEY AND APPRAISAL
	IN DEPTH SURVEY FORM E2 HEATING GENERATING PLANT
	FORM 4-1 PAGE 7 OF 19 DATE: BY:

HEAT GENERATING PLANT (cont'd)

7. Economizer: _____

8. Air Heater: _____

9. Deaerator: _____

10. Feedwater Heater: _____

7. Chemical Treatment _____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E3 - REFRIGERATION PLANT

FORM 4-1
PAGE 8 OF 19
DATE:
BY: _____

REFRIGERATION PLANT

1. Function: Comfort cooling__ Process__: describe

2. Type: Reciprocating__ Centrifugal__ Absorption__ Screw__ Remote Source_____
   Room__ Unitary__ Central__ DX__ or Ch W__ distribution

3. Arrangement:

   Refrigerant: Parallel__ Staged__ Separately circuited__

   Ch.W.: Parallel__ Series__ Series/Parallel__ Once-thru prechilling__
   All areas served from one system?__

   Cond. Water: Parallel__ Series__

4. Schedule of Refrigeration Equipment:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)
Unit No	Manufact.	Model No.	Chilled Water GPM	Chilled Water EWT	Chilled Water LWT	Tons	Cond. Water GPM	Cond. Water EWT	Cond. Water LWT	Type Drive	BHP	MHP	Type Start
R-1													

Totals - Installed Capacity_____
Calculated Design Peak_____
Actual Logged Peak_____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E3 - REFRIGERATION PLANT

FORM 4-1
PAGE 9 OF 19
DATE:
BY:

For each Refrigeration Unit, tabulate below; if an Absorption Unit - the steam pressure or water gpm and temperature range; if an engine or gas turbine drive its fuel, rpm, etc.; if a steam turbine drive - its #/hr throttle and exhaust conditions; if built-up DX - the refrigerant, its S.T. and C.T.; if a heat pump - whether double-bundle, closed circuit tower, internal or external heat source; indicate basic control mode and sequencing order for appropriate % plant load; area, or process served; standby?

6. Condensing: Air___ Open___ or closed___ circuit tower Evap Cond___ Once-through water (potable___ or non-potable___ well___, lake___, river___ city water___.)

For data on Condenser Water Systems, see "Coolant System" form.
See below for Evap Condensers.

Winterized

7. Evaporative Condenser: Mfr._____ Model No._____ _____Tons Blow___ or draw___ thru

Outdoor___ or indoor___ No. modules___ ____CFM at___ F Wbt

____GPM Refrigerant____ CT____ F ST____ F Fan____MHP

Chemical treatment:

Other Major Plant Equipment and Auxiliaries

See "Chilled Water Distribution System" form for this data

See relevant HVAC Equipment for utilization apparatus

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E6 - HOT WATER DISTRIBUTION SYSTEM

FORM 4-1
PAGE 10 OF 19
DATE:
BY: _____

1. Media: LTW__ MTW__ HTW__ Generated in or for this bldg alone__, other bldgs__ Remotely heated__

2. Function: Comfort heating__ Process__ Qty of separately pumped circuits__

3. Pumping: Primary__ (____ to ____°F) Secondary__ (____ to ____°F) Terminal pumping__ Terminal booster pumping__ Single__ or dual__ temp loop__ or radial__ Reverse__ or direct__ return 2__ or 3__ pipe Hydraulic isolation of secondary?__ Open__ or closed__ expansion tank with inert gas__ charging.

4. Schedule of Hot Water Pumps

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Pump No.	P,S,	Mfr, Mod & Size	PUMP DATA					MOTOR		Starter Type
			GPM	TDH '	RPM	BHP	Type	MHP	Type	
HWP-1										

For each pump indicate space(s) served; speed or pressure control; seal coolant; control mode in main circuits and terminal equipment; approx length of longest circuit for each pump; number of terminal coils connected to it; identify pumps in each common system, whether in series or parallel mode; thermal fluid other than water.

HWP-1

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E6 - HOT WATER DISTRIBUTION SYSTEM

FORM 4-1
PAGE 11 OF 19
DATE:
BY:

5. Schedule of Apparatus Served:

1. Absorption Units: Qty___ See Refrig Plant Form

2. Air Conditioners and Air Handlers: See those forms

3.

(1) Converter No.	(2) Heating Media GPM	(3) EWT	(4) LWT	(5) Heated Media Media	(6) Function	(7) Flow	(8) Ent	(9) Lvg	(10) Controls
HWC-1									

4. Cast Iron Radiators: (Small-Tube, Large Tube, Columnar Type) ____ to ____°F

(1) Type S,L, or C	(2) No. Tubes	(3) No. Col.	(4) Data Each Sect. H"	(5) W"	(6) L"	(7) Btuh	(8) No. Sect	(9) Rad Btuh	(10) No. Rads	(11) Total Btuh	Control

5. Finned Tube Units: (Convectors, Commercial Radiation, Baseboard) ____ to ____°F

(1) Type	(2) Element Data & Performance Material	(3) Rows	(4) Fin	(5) Diam."	L'	(6) Btuh/Ft	(7) Enclosure Type	Ht"	(8) Btuh	(9) Qty or Tot L'	(10) Total Btuh

Describe controls:

POPE, EVANS AND ROBBINS

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E6 - HOT WATER DISTRIBUTION SYSTEM

DATE:
BY:

6. Unit Heaters: (Propeller or centrifugal fan, vertical or horizontal blow, draw or blow thru) ____ to ____°F

(1) Unit No.	(2) Type	(3) AIR DATA CFM	(4) AIR DATA EDB	(5) AIR DATA LDB	(6) Motor Data Btuh	(7) Motor Data MHP	(8) Motor Data RPM	(9) Motor Data Starter	(10) Controls

7. Chemical Treatment:

8. Hot Water Storage (For Space Htg)

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E7 - CHILLED WATER DISTRIBUTION SYSTEM

FORM 4-1
PAGE 13 OF 19
DATE:
BY: _____

1. Media: Ch.W.__ Once-thru__ (well__, lake__, river__, or City__ water) Evap Cooled__ Generated in or for this bldg alone__, other bldgs__, or remotely chilled__ Closed__ or Open__ system

2. Function: Comfort cooling__ Process__ Qty of separately pumped circuits__

3. Pumping: Primary__(P), Terminal__(T), or Booster__(B) pumping from ___ to ___°F Secondary__(S) pumping (___ to ___°F) Single__ or dual__ temp loop__ or radial__ Reverse__ or direct__ return 2- or 3-pipe Hydraulic isolation of secondary?___ Open__or closed__ expansion tank Glycol__ or brine__

4. Schedule of Chilled Water Pumps:

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		(11)
QTY	Pump For Syst	P,S, T,B	Mfr.Mod & Size	PUMP DATA GPM	TDH	RPM	BHP	Type	MOTOR MHP	AMPS NME	RUN	STARTER Type

For each pump indicate space(s) served; speed or pressure control (i.e. V.S.P., choke, relief by pass) control mode in main circuits and in terminal equipment; approx length of pipe in longest circuit of each pump; number of terminal coils connected to it; identify pumps in each common system, whether in parallel or series mode; media other than Ch.W.; if not for comfort cooling, indicate process.

_____

_____

_____

_____

_____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN-DEPTH SURVEY FORM

E7 - CHILLED WATER DISTRIBUTION SYSTEM

FORM 4-1
PAGE 14 OF 19
DATE:
BY:

5. Schedule of Apparatus Served:

   See separate forms for "HVAC Systems"

6. Secondary Chiller: Primary GPM___, ___ to ___°F Secondary GPM ___, ___ to ___°F

7. Process Cooler Schedule:

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
Unit No.	Mfr.	Function	Chilled Water GPM	Chilled Water EWT	Chilled Water LWT	Process Media Type	Process Media Flow	Process Media ET	Process Media LT	Remarks

8. Chemical Treatment:

AL

(1)	(2)	(3)	(4)	(35)	(36)
RUN NO	MDS AIR UNIT NO.	GROSS AREA		ATING EXHAUST FANS	
		HVAC	H & V	T UIT NOS	TOT CFM

LEGEND

AUTO	=	AUTOMATIC
BHP	=	BRAKE UP
CC	=	COOLING COIL
HTG	=	HEATING (BOOSTER)
H&V	=	WITHOUT COOLING
HVAC	=	INCLUDES COOLING
MAN	=	MANUAL
MDS	=	MAINTENANCE DATA SYSTEM
MER	=	MECHANICAL EQUIPMENT ROOM
MHP	=	MOTOR HP
NMP	=	NAMEPLATE AMPS
OA	=	OUTSIDE AIR
PH	=	PREHEAT
RA FAN	=	RETURN AIR FAN
RHT	=	REHEAT
RPM	=	REVOLUTIONS PER MINUTE
RUN	=	RUNNING AMPS
S.A.	=	SUPPLY AIR
SYS	=	SYSTEM
TSP	=	TOTAL STATIC PRESSURE, INCHES WG
VORT DAMP	=	VORTEX DAMPER

FACILITY BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

AIR HANDLING HVAC SYSTEMS
E8- ALL AIR

FORM 4-1
PAGE 15 OF _____
DATE
BY _____

(1) RUN NO	(2) MDS AIR UNIT NO.	(3) GROSS AREA HVAC	(4) GROSS AREA H&V	(5) GROSS AREA TOT	(6) AIR VOLUME (CFM) S A	(7) %	(8) MINIMUM OUTSIDE AIR ONCE THRU HVAC	(9) ONCE THRU H&V	(10) PARTIAL OA HVAC	(11) PARTIAL OA H&V	(12) SYS DESCRIPTION TYPE SYS	(13) NO ZONES	(14) RA FAN	(15) AIR UNIT CONTROLS VARIABLE OA % MAX	(16) % MIN	(17) AUTO/MAN	(18) VORT DAMP	(19) COOLING/HEATING COILS MAIN AIR UNIT PH	(20) CC	(21) RHT	(22) TERMINALS CC	(23) RHT	(24) HTG	(25) AIR UNIT DATA ORIG EQUIP DATA FAN TSP	(26) RPM	(27) MOTOR MHP	(28) BHP	(29) PRESENT OPERATION FAN TSP	(30) RPM	(31) MOTOR NMP	(32) RUN	(33) MER LOC	(34) ROOM TYPES HANDLED	(35) MATING EXHAUST FANS UNIT NOS	(36) TOT CFM

LEGEND

AUTO	=	AUTOMATIC
BHP	=	BRAKE UP
CC	=	COOLING COIL
HTG	=	HEATING (BOOSTER)
H&V	=	WITHOUT COOLING
HVAC	=	INCLUDES COOLING
MAN	=	MANUAL
MDS	=	MAINTENANCE DATA SYSTEM
MER	=	MECHANICAL EQUIPMENT ROOM
MHP	=	MOTOR HP
NMP	=	NAMEPLATE AMPS
OA	=	OUTSIDE AIR
PH	=	PREHEAT
RA FAN	=	RETURN AIR FAN
RHT	=	REHEAT
RPM	=	REVOLUTIONS PER MINUTE
RUN	=	RUNNING AMPS
S.A.	=	SUPPLY AIR
SYS	=	SYSTEM
TSP	=	TOTAL STATIC PRESSURE, INCHES WG
VORT DAMP	=	VORTEX DAMPER

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH SURVEY FORM

H - COOLANT SYSTEMS

FORM 4-1
PAGE 16 OF 19
DATE:
BY: _____

1. Media: Recirculated water____ Once-thru____ (well___,lake___, river___ or city___water) Air-cooled coil____, with____ or without____spray Open cooling tower____ Does system feed other bldgs?_____

2. Function: Steam____ or refrigerant____ condensing for comfort____ or process____ Other process____ Qty of separately pumped circuits

3. Pumping: Primary(P)__, terminal(T)__, or booster(B) pumping (____to____to____°F), Loop____or radial____ Reverse____or direct____return Open____or closed____ expansion tank Glycol____

4. Schedule of Coolant Pumps: (Condenser Water = CWP; Process = PWP____)

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)		(11)			
QTY	Pump No. For Syst.	P,T B	Mfr., Model & Size	Pump Data GPM	TDH'	RPM	BHP	Type	Motor MHP	AMPS NME	AMPS RUN	TOWER FANS QTY	MHP	AMPS NME	AMPS RUN

For each pump indicate equipment served; speed or pressure control; control mode in main circuits and terminal equipment; approx length of pipe in longest circuit of each pump; number of heat exchangers connected to it; identify pumps in common systems, whether in parallel or series mode.

_____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH SURVEY FORM

H - COOLANT SYSTEMS

FORM 4-1
PAGE 17 OF 19
DATE:
BY: _____

(cont'd)

_____

_____

5. Sediment Screens and Filters: Describe _____

_____

_____

6. Cooling Tower: Mfr _____ Model No. ____ ____ Tons Refrig, or _____ Mbh rejection Blow ____ or draw ____ thru, or natural draft ____ No. cells ____ _____ GPM from ____ to ____ @ _____ °F wbt

Type _____ Construction _____ Fan ____ MHP/Cell

If closed circuit: _____ GPM thru coil from _____ to _____ °F @ _____ °F dbt

Recirculating spray: _____ GPM Pump ____ MHP

Chemical Treatment: _____

_____

_____

Winterization equipment and control: _____

_____

_____

_____

EXPLANATORY NOTES	FACILITY: BUILDING: BUILDING ENERGY SURVEY AND APPRAISAL	
	IN DEPTH SURVEY FORM H - COOLANT SYSTEMS	FORM 4-1 PAGE 18 OF 19 DATE: BY:

(cont'd)

7. Once-Through Coolant
~~Potable~~ ____ ~~or non-potable~~ ____ Supply Temp: Summer ____ F Winter ____ F

Quality: _____

_____

_____

Non-Coolant uses: _____

EXPLANATORY NOTES

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

IN DEPTH SURVEY FORMS

I - INDUSTRIAL & PROCESS SYSTEMS

FORM 4 -1
PAGE 19 OF 19
DATE:
BY: _____

NOTE

Tabulation indicates the installed load (nameplate data) when available.

(cont'd)

(1) Mfr & Mod No.	(2) Name of Machine &/or Function	(3) Daily Hrs.	(4) Elect. Energy Input KW Heat	(5) Power	(6) Avg LF	(7) Thermal Energy Input Media	(8) Btuh F.L.	(9) Avg LF

Totals: Installed_____

Peak Demand: Actual____ Estimated____

FORM 4-2

INDIVIDUAL ECO ECONOMIC APPRAISAL FORMS

REF: SECTION 4B.4.3, Page 4-6, Vol. 1

PURPOSE: To assist with preliminary calculations and data presentation for economic appraisal of individual ECOs. The final economic appraisal of ECOs shall be performed based on the methodology described in ERDA-130/76 "Life Cycle Costing Emphasizing Energy Conservation" and summarized in Chapter 4, Volume 1 of this HANDBOOK.

FACILITY: BUILDING

BUILDING ENERGY SURVEY AND APPRAISAL

EXPLANATORY NOTES

ENERGY CONSERVATION OPPORTUNITIES - ECONOMIC APPRAISAL

**INDIVIDUAL APPRAISAL ( )
COMPREHENSIVE APPRAISAL ( )

ECO NO.....
DESCRIPTION.....

FORM 4-2
PAGE 1 OF 1
DATE:
BY _____

**(1) Use source Btu ____ thru (9).-do not use these columns for no cost ECOs.
(2) FIRA mandated discount rate for capital projects (See CHAP.4, VOL. 1
** Col(5) ÷ col (6)
___ expected life of equipment being installed
(4) See CHAP.4, VOL.1

Line A - enter prime energy data,i.e. electricity for lighting ECOs.
Line B,C-enter secondary energy gains or losses(i.e. for lighting, add'l heat load & savings in cooling loads).
Line ___ - enter annual O&M and incremental (e.g.reduced security costs from automatic control) costs and/or savings in column (4).
Line H-See CHAP.4, VOL.1
Line I-value of installed equipment @ end of life,if any.
Line J- See CHAP.4, VOL. 1
Line K- Line H - Line J
Line L-Line K ÷ Line F, col (9)

Line M - See CHAP.4, VOL.1
Line N - See CHAP.4, VOL.1
Line O - Line F,col(9) ÷ Line K

	TYPE	(1) ANNUAL SAVINGS BTU X 10^6 BDRY	(1) ANNUAL SAVINGS BTU X 10^6 SOURCE	(2) PHYSICAL UNITS	(3) UNIT COST	(4) $	(5) DISCOUNT RATE	(6) DIFFERENTIAL COST ESCAL.	(7) EFFECTIVE INTEREST RATE	(8) LIFE OF EQUIPMENT	(9) PRESENT VALUE
A. PRIME ENERGY											
B. SECON. ENERGY 1			*			*					*
C. SECON. ENERGY 2			*			*					*
D. TOTAL ENERGY											
E. NET NON-ENERGY RECURRING COSTS OR SAVINGS						*					*
F. NET OPERATING SAVINGS											

G. CAPITAL COST.....
H. PRESENT VALUE OF CAPITAL COST.....
I. RESIDUAL VALUE.....
J. PRESENT VALUE OF RESIDUAL VALUE.....
K. NET PRESENT VALUE CAPITAL COST.....

L. SIMPLE PAYBACK PERIOD.....
M. OVERALL EFFECTIVE INTEREST RATE..
N. DISCOUNTED PAYBACK PERIOD.....
O. SAVINGS/INVESTMENT RATIO.....

*USE PARENTHESES TO INDICATE REDUCTION OR GAINS.

** CHECK "INDIVIDUAL APPRAISAL" WHEN ECO IS BEING EVALUATED INDIVIDUALLY AND "COMPREHENSIVE APPRAISAL" WHEN IT IS BEING EVALUATED TAKING HIGHER RANKING ECOS FROM FORM 4-3 INTO ACCOUNT.

FORM 4-3

ECO ECONOMIC APPRAISAL

SUMMARY SHEET

REF: SECTION 4B.4.4, Page 4-6, Vol. 1

PURPOSE: To assist in ranking of feasible ECOs and in the presentation of total energy savings and total capital costs involved. ECO ranking methodology is presented in ERDA-130/76 "Life Cycle Costing Emphasizing Energy Conservation" and summarized in Chapter 4, Volume 1 of this HANDBOOK.

FACILITY: BUILDING:

BUILDING ENERGY SURVEY AND APPRAISAL

ENERGY CONSERVATION OPPORTUNITIES - ECONOMIC APPRAISAL

SUMMARY SHEET

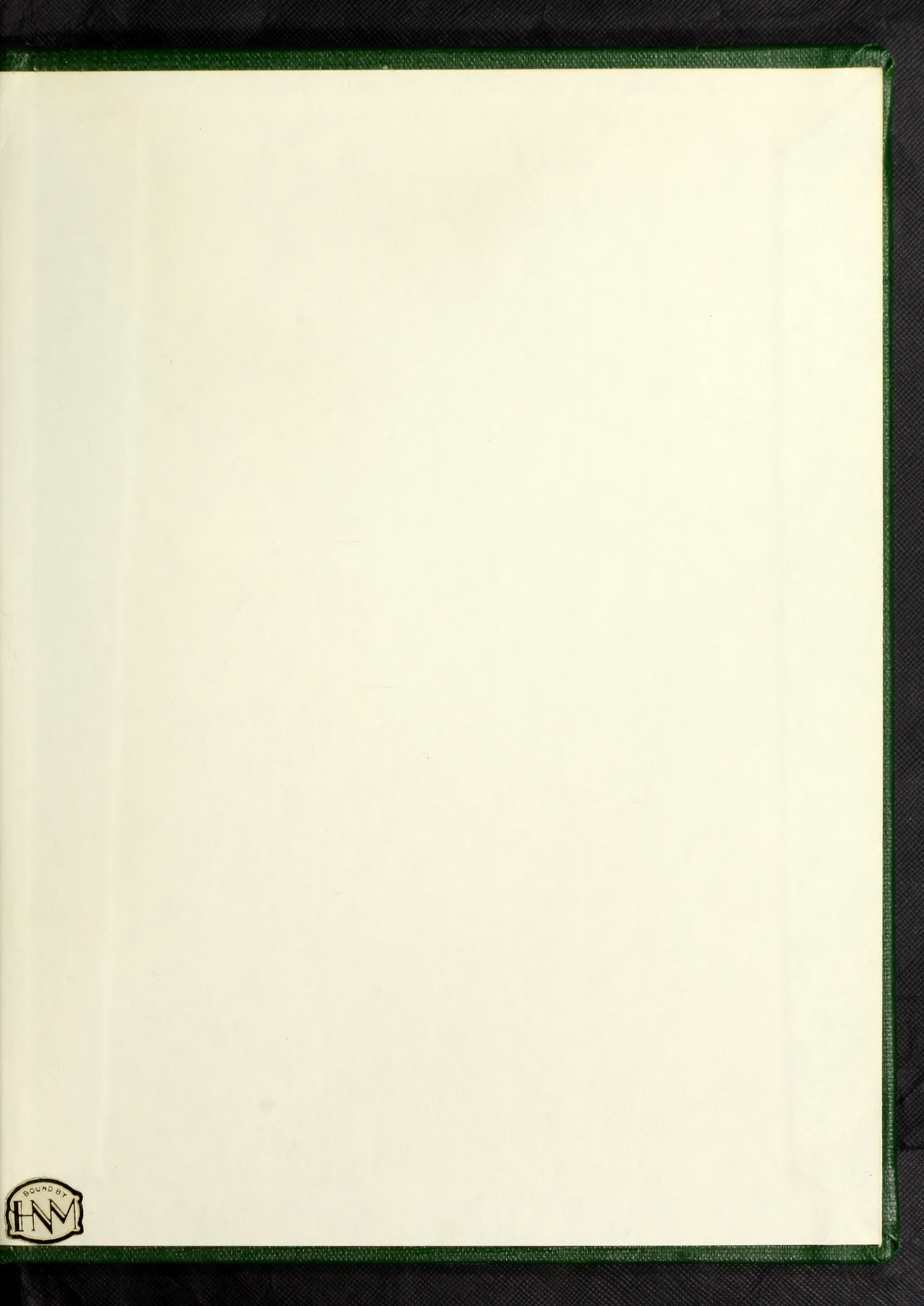
FORM: 4-3
PAGE 1 OF 1
DATE:
BY: _____

EXPLANATORY NOTES

(1) Rank ECOs in order of individual savings/investment ratio, highest ratio first.
(2) From Form 4-3.
(3) Individual Appraisal Line M
(4) Ditto, Line O
(5) Form 4-3(11) the comprehensive appraisal adjusts energy savings to take the effect of previous ECOs into account. For example, if the first ECO increases the efficiency of the cooling system and the second reduces the lighting load, the cooling energy saved through reduced lighting may be decreased changing the figures on Form 4-2 Lines B&C. Form 4-2 should in this case be completed again.
(6) Form 4-2 Comprehensive Appraisal Line F, Col. (4)
(7) Ditto, Line G
(8) Ditto, Line N
(9) Ditto, Line O
(10) Ditto, Line D, Column 1
(11) This Sheet- column (10) x 10^6 x Form 4-2 Column (8) ÷ Form 4-2 (1), Line K

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
	ECO		INDIVIDUAL APPRAISAL		COMPREHENSIVE APPRAISAL					
RANK	NO.	DESCRIPTION	DISCOUNTED PAYBACK PERIOD	SAVINGS INVESTMENT RATIO	NET ANNUAL SAVING $	CAPITAL INVESTMENT $	DISCOUNTED PAYBACK PERIOD	SAVINGS/ INVESTMENT RATIO	ANNUAL ENERGY SAVING BTU $\times 10^6$	BTU SAVING/ INVESTMENT DOLLAR
		TOTAL								

POPE, EVANS AND ROBBINS


BOUND BY
HNM